SCIENTIFIC AMERICAN

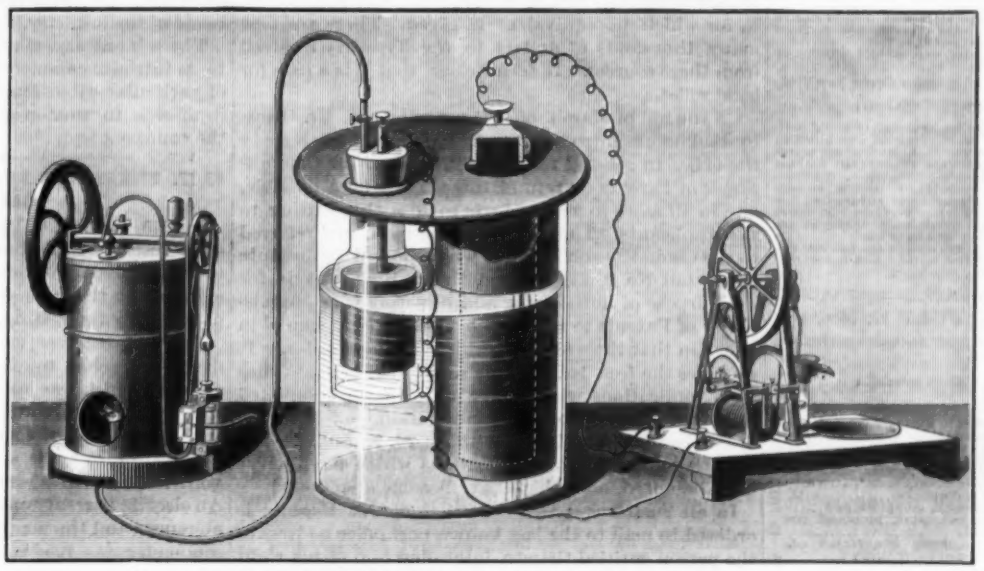
[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LV.—No. 3. [NEW SERIES.] NEW YORK, JULY 17, 1886. [Price 10 Cents. $3.00 per Year.

TRANSFORMATION OF PHYSICAL FORCES.

One of our readers communicates to us an arrangement of the Bunsen battery by means of which he performs a very curious experiment on the transformation of physical forces. The annexed figure shows the general arrangement. The pile is constructed as follows: The zinc, instead of being tubular and surrounding the porous cup, is a solid cylinder, and is suspended beneath a bell glass, which is itself fixed to a wooden cover that hermetically closes the vessel through the intermedium of wax or cement. The bell glass is closed by a rubber stopper provided with two tubulures. One of these latter gives passage to the copper rod which supports the zinc, and which serves as an electrode, while the other is provided with a tube and cock that gives exit to the hydrogen gas formed. The cock, when opened or closed, opens or closes the circuit. In effect, in the first case, the hydrogen escapes, and, in the second, having no exit, it accumulates in the bell and expels the liquid. The pile then ceases to work, as the zinc is no longer immersed. The carbon and the porous cup containing the acid are arranged alongside of the bell in the usual manner.



TRANSFORMATION OF PHYSICAL FORCES.

The experiment that this pile permits of performing is as follows: The metallic conductors fixed to the two poles are connected with a small electric motor, which operates as soon as a contact is established. The disengaged hydrogen is led by means of a rubber tube beneath the boiler of a small steam engine, and, when lighted, soon boils the water and sets the engine running.

We thus have at the same time a generator of heat and electricity. This is a pretty lecture experiment, and we recommend it to physicists.—*La Nature.*

ESTRADE'S HIGH SPEED LOCOMOTIVE.

Our collaborator Mr. Audra has already described* Mr. Estrade's conception of a type of railway rolling stock of a speed such as has never as yet been attained. Such conception is at length a reality, and there may now be seen in the shops of Messrs. J. Boulet & Co., of Paris, the locomotive and its tender entirely mounted and ready to operate. It is impossible not to be struck by the character of grandeur and power of this beautiful engine, with its six driving wheels, of one diameter in common of 8¼ feet, mounted upon three coupled axles.

The inventor's idea, it will be remembered, consists in generalizing the use of wheels of large diameter, in the extension, to high speeds, of the coupling of the axles of the motor, and in the adoption of a new and well studied style of double suspension.

The principal dimensions are as follows: Total length, 33 feet; width between longitudinals, 4 feet; diameter of the wheels, 8¼ feet; weight of engine, empty, 38 tons; weight of engine, loaded, 42 tons.

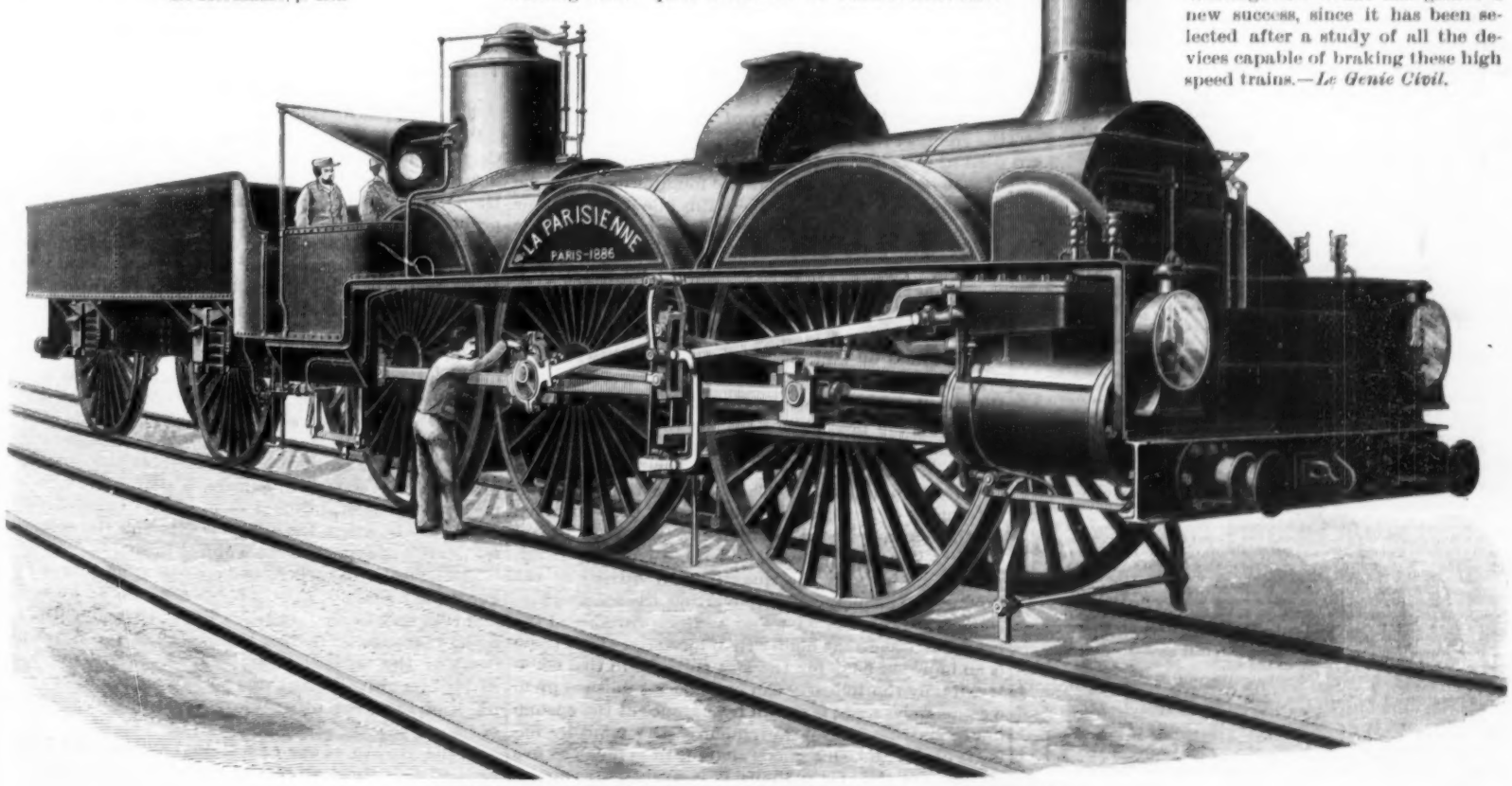
We shall not now return to a theoretic discussion of the qualities of this engine. Mr. Estrade has peremptorily answered this with faith and generosity by having built, as carefully as possible, and of true size, the one-tenth size model that he had deposited in the galleries of the Conservatoire des Arts et Metiers, and concerning which quite a number of controversies have already arisen. It is to be wished that some experiments shall soon be performed, either upon the lines of our large companies or upon those of the State. They will be deeply interesting and instructive. It does not appear doubtful that it will be possible to reach the high speeds of from 72 to 78 miles, for which this locomotive has been constructed. The equal size of the locomotive wheels, and of those of the cars, will, doubtless, in a great measure diminish the resistances of friction, and permit of gaining in speed.

It must be noted that the fore axle of the locomotive, although coupled with the others, is provided with hinged grease boxes. On properly slowing up, then, it does not seem that it will be impossible to turn curves of the usual radius.

This granted, we can appreciate what peculiar services will be rendered by rolling stock of this kind in the India mail service and on the great rectilinear lines of Russia, Asia, and the New World, and everywhere, in fact, where it is desirable to cross with exceeding rapidity great desert spaces between centers of population. Were it from but this standpoint, Mr. Estrade's rolling stock would merit being taken into serious consideration; and it is very desirable that the experiment shall be performed in France, since it is a question of a French idea, all the expenses attending the carrying out of which have been liberally defrayed by one of our compatriots. These experiments will give us new hints, and will permit of passing a definite opinion very opportunely at the moment when Mr. Crampton, the eminent English engineer, improving upon the beautiful and effective engine to which he has given his name, is proposing a new model with three axles, of which two are to be coupled, and which are to carry wheels 6¾ feet in diameter.

In Mr. Estrade's *materiel*, the Westinghouse brake has gained a new success, since it has been selected after a study of all the devices capable of braking these high speed trains.—*Le Genie Civil.*

* See SUPPLEMENT, p. 8556.



ESTRADE'S HIGH SPEED LOCOMOTIVE LA PARISIENNE.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... $3 00
One copy, six months, postage included..... 1 50

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.00 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, JULY 17, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Acid, uric, in the animal body, on the place of origin of..... 37
Albany bidentennial..... 34
Beetle, carpet, the Buffalo..... 35
Books and publications..... 42
Business and personal..... 42
"Can imagination kill?"..... 40
Car coupler tests, report of the N. Y. Railroad Commission on*.. 36
Car coupling, Brennan's*..... 34
Car coupling, Carruther's*..... 34
Carriage, child's*..... 40
Casting process, centrifugal..... 37
Colliery winding engine*..... 39
Collision bells and harmonic impact*..... 38
Corks, impervious..... 35
Diversity of opinion..... 34
Door securer, Simon's*..... 34
Drain tile protector*..... 40
Electric battery, improved..... 33
Engine, winding, for Australia*... 33
Exhibition, Edinburgh, the..... 37
Gas, natural, at Findlay, O..... 33
Grafting, heterogeneous..... 41
Hinge, improved, Wheeler's*..... 34
Inventions, agricultural..... 42
Inventions, engineering..... 42
Inventions, index of..... 43
Inventions, miscellaneous..... 42
Keep on the alert..... 34
Light, polarized*..... 38
Locomotive, high speed, Estrade's*..... 31
Magnesia in Portland cement..... 37
Marmoset, silky*..... 41
Metals, reducing, new mode of... 41
Nation's great problem, the..... 32
Norrenberg doubler and the study of thin films*..... 38
Notes and queries..... 42, 43
Observatory, mountain, new..... 41
Patent legislation, proposed, recently..... 32
Photographers, convention of, annual..... 36
Photographic notes..... 33
Physical forces, transformation*. 31
Pneumatic pressure relief governor*..... 35
Railway cross ties*..... 40
Saccharine, inventor of, the..... 36
Shaving mirror, Phillips'*..... 34
Sleeping disease, the..... 40
Smell, sense of, delicacy of..... 37
Sound, telegraphing, early experiments in, Prof. Pickering's 32
Stoppers, removing..... 41
Subways, electrical, for New York 36
Telegram, young father's first ... 35
Telescope, Lick, mounting..... 35
Thermometer with electric alarm* 39
Tie, white cedar, section of, with spike driven in*..... 40
Valve, slide, how to set..... 37
Ventilation by flues..... 34
Water level indicator*..... 35
Water, sea, as a preservative..... 40

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 550.

For the Week Ending July 17, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—The Centenary of Parmentier, the great French Agriculturist.—His introduction of the potato into France, and subsequent experiments with Indian corn, the chestnut, and bread products.—2 illustrations..... 8788

On the Application of Human Excreta as Manure: The Department of Urea toward Soils.—A brief abstract of the result of an experimental investigation carried out at Komaba Agricultural College, Tokio, Japan..... 8789

II. ELECTRICITY.—An Improved Method of Cable Working.—By J. EBEL.—An arrangement by which a higher rate of speed can be obtained in long distance telegraphy.—3 figures..... 8784

Domestic Electricity.—A description of the electric alarm known as the "chronophone," and a portable electric lighter.—2 illustrations..... 8784

III. ENGINEERING AND MECHANICS.—The Ship Railway.—An open letter concerning the Tehuantepec ship railway, written by Mr. J. J. WILLIAMS, C.E., to Senator JOHN J. MORGAN..... 8777

Steel Castings.—Three tables giving the details of tests of small steel castings representing articles of common use in forged iron or brass castings in ships of war..... 8777

New Harbor on the West Coast of India.—A description of the harbor works at Mormugao, near Goa, now under construction by the West of India Portuguese Guaranteed Railway Co.—2 illustrations..... 8780

Distribution of Power in a Woolen Mill.—An analysis of the power actually used in driving the machinery in a mill in Central Ohio..... 8790

IV. GENERAL PHYSICS.—Flame Contact, a New Departure in Water Heating.—By THOMAS FLETCHER.—The use of metallic rods or angle ribs in steam boilers to increase the duty of fuel..... 8783

On Certain Properties Common to Fluids and Solid Metals.—By Prof. W. C. R. AUSTEN, F.R.S.—The experiments of Reaumur, Osborne Reynolds, and Lemery.—The analogy between fluids and solid metals with respect to the rejection of impurities on solidification, surfusion, flow under pressure, changes due to compression, absorption of gases and liquids, diffusion, vaporization, and surface tension.—14 figures..... 8786

V. MARINE ARCHITECTURE AND ENGINEERING.—British Lifeboats.—The details of the lifeboat intended to be stationed at Lytham, at the mouth of the Ribble, and now at the Liverpool Exhibition.—7 figures..... 8775

Steam Lifeboats, an Opportunity for Inventors.—The discussion before the Institute of Naval Architects.—The essential requisites in the motor of a lifeboat..... 8775

Compressed Air for Lifeboats.—The many advantages possessed by this form of motive power, as compared with steam or manual exercise..... 8776

The Raising of a Wrecked Steamship.—The system employed by Mr. Thomas W. Wailes in raising the Peer of the Realm, lying on the rocks at the east side of Lundy Island..... 8776

VI. ORGANIC CHEMISTRY.—Gossypin, the Coloring Principle of Cotton Seed.—The expression of the chemical from the seed and its use in dyeing..... 8788

New Element of the Blood.—The third histological element, the "plaquer" announced by Mr. Geo. T. Kemp..... 8790

VII. SANITARY ENGINEERING.—The Purification of Water by Alum.—By Prof. P. T. AUSTEN.—Its particular application to localities where purification of the water is only necessary at certain seasons of the year, and where the expense of large pumps and filters would be a serious tax..... 8782

The Plumber as a Sanitarian.—His preventive virtues..... 8784

Cremation of Garbage.—By JOHN ZELLWEGLE, C.E.—The construction of furnaces for carrying out this method of disposal.—5 figures..... 8785

VIII. TECHNOLOGY.—Refrigerating and Ice Making Machinery and Appliances.—By T. LIGHTFOOT.—Apparatus for abstracting heat by the rapid melting of a solid, and by the evaporation of a more or less volatile liquid.—Machinery for compressing and cooling a gas.—First paper..... 8778

The Prevention of Naphthalene Deposits.—An apparatus for use in the manufacture of illuminating gas.—1 figure..... 8782

RECENTLY PROPOSED PATENT LEGISLATION.

In many cases, improperly drawn specifications, with drawings not acceptable under the Patent Office rules, have been forwarded to the Commissioner of Patents, accompanied by the preliminary fee of fifteen dollars. Of such applications, some have gone no farther, the necessary alterations and amendments not having been made. In other cases, inventors, ignorant of the laws relating to patents, have sent to the Commissioner a simple statement to the effect that they proposed to take out a patent for certain inventions, and with this statement have forwarded the preliminary fee of fifteen dollars. Again, it often happens that the final fee of twenty dollars is paid in, and the application abandoned after such payment. Sometimes the entire fee of thirty-five dollars is sent in advance with the application, which is subsequently abandoned. Hitherto, and at present, in such cases the amount received in excess by the Commissioner cannot by law be returned. Much injustice is apparent in these transactions. Money is received by the government, and retained by it, for which no equivalent is given. There are now many thousands of dollars in the Treasury received from these sources. It seems clear that it is a case for legal relief.

On the 22d of March of the present year, Mr. Ormsby B. Thomas introduced a bill designed to remedy the evil. In general terms, it authorized the Commissioner of Patents to refund these fees where possible, and in all cases to make efforts to do so by writing to the applicants. The bill was twice read, and referred to the Committee on Patents, who reported a substitute (H. R. bill No. 9,474) on the 16th of June. It is for the purpose of authorizing and directing the Commissioner of Patents to notify the class of applicants in question that their fees are subject to their order. It classifies the fees, 1st, as those sent to the Patent Office with applications which have never been completed or placed in condition for examination, and have become abandoned by lapse of time; 2d, as final fees of twenty dollars paid on applications which have never been patented, and which have become abandoned.

In all such cases, the Commissioner of Patents is ordered to mail to the last known post office address of the person entitled thereto, informing him of his right to the sum in question, and stating that the amount will be forwarded to him on his written request for it. When the request is received, the Commissioner is directed to return the money, under such rules as may be required to efficiently and safely carry out the provisions of the proposed law. In order to prevent any further accumulation of fees paid by mistake, the Commissioner is authorized to refund them, for the future, as soon as received, drawing upon the current receipts of the office.

The provisions of the bill above summarized seem eminently just ones. The fees of thirty-five dollars received by the Patent Office are intended to pay for the cost of searching for novelty, for clerical expenses, printing, lithographing, and the like. There was never any idea of making them a source of profit or of general revenue to the government. Under equitable management, the amounts received by the office should be spent upon forwarding its business, and expediting the issuing of patents. When, therefore, through error or otherwise, fees are paid for which no return is given in the way of a search for novelty, and other work involved in the completion of the application, or for which, as in the case of final fees, no issuing of a patent has been effected, it seems unjust for the government to retain the amounts so received. A large surplus exists to-day in the Treasury of the United States to the credit of the Patent Office. Much of it has been derived from the sources described. The repayment of as many inventors as could be found would not, we are convinced, seriously deplete this idle amount. For the future, if the revenues were somewhat reduced, it would be only equitable and just to submit to such reduction. The government should in no sense be a money maker, and should receive no fees that it is not justly entitled to.

PROGRESS OF SILK CULTURE IN THIS COUNTRY.

From the Sixth Annual Report of the Women's Silk Culture Association of the United States, it appears that while the present outlook for the industry is not as bright as it might be, there is still much to encourage its advocates in believing that it will one day win for itself an important place among the industrial enterprises of America. The number of those engaged in the culture of silk cocoons in the agricultural districts is on the increase, and there has been an improvement in both the quantity and quality of the product. The methods of converting the cocoons into commercial raw silk have also been improved, and the prices are somewhat higher than formerly. That there is an immense field for the silk culturist in this country, if only the industry can once be established upon a commercial basis, is shown by a glance at the custom house statistics. Not infrequently the monthly imports of silk and silk goods amount to as much as five million dollars. Or perhaps it is even better appreciated when one studies the attire of any American assembly. A decided preference is shown for the various kinds of dress goods made out of silk.

A recent feature in the work of the Association has been its management of the Government Experimental Station in silk culture. A filature, or silk reeling station, was established in Philadelphia, and a line of shafting was introduced, with arrangements for six reels. Early in June, 1885, three American reels were put into operation. A market was soon found for all the reeled silk produced, and also for all the waste, so that the undertaking may be said to rest on a business footing. The small quantity of cocoons produced, and the lack of experience in their culture, coupled with the high price of expert reelers, have been serious drawbacks to the financial success of the enterprise. But these are accidental circumstances, and will be dispelled, it is believed, by the results of the next two or three years. It is pleasant to record the fact that the three reels made in Philadelphia are pronounced by experts to be superior to any of those imported, not excepting the improved forms brought from the very home of the industry, Southern France.

There is one aspect of silk culture which, in addition to its intrinsic commercial importance, makes it worthy of particular attention. And this is the employment it affords to women and children whose homes are in the country.

PROF. PICKERING'S EARLY EXPERIMENTS IN TELEGRAPHING SOUND.

In 1870, Prof. E. C. Pickering, then of the Massachusetts Institute of Technology, illustrated to an audience the transmission of sound by electricity in an experiment which the present telephone controversy makes particularly interesting.

His first receiver consisted of a powerful electromagnet attached to the bottom of a wooden box, the cover of which was replaced by a tin plate, having a soft iron armature attached to its center. The armature approached the magnet, but was not in contact. The transmitter was a sonometer, around the wire of which a short wire was wound, dipping into mercury. An electric current was passed through both wires, the mercury, and the magnet. When the main wire of the sonometer was made to vibrate, the current at each vibration was broken at the surface of the mercury. When the circuit was made, the magnet drew the plate down; and when broken, the elasticity of the plate drew it back. A loud sound was thus produced, the pitch of which could be varied by changing the length or tension of the wire of the sonometer. This experiment was shown to the American Association for the Advancement of Science, at its annual meeting, and was repeated in the course of several lectures. On again repeating this experiment in 1879, when the subject of the transmission of sound by means of electricity had assumed commercial importance, it was found that ordinary conversation could be heard as readily as musical notes.

From this it will be seen that as far back as 1870 a receiver was devised which consisted of a flexible iron diaphragm supported at its sides, and replacing the armature of an electro-magnet—a receiver, in fact, which differed in no way from that now in use. In 1879, the possibility of its use as a telephone was also demonstrated, and though intended originally for a discontinuous current, it was equally suitable for a continuous one. The apparatus used in these early experiments is now in the possession of the Institute of Technology.

THE NATION'S GREAT PROBLEM.

Prof. R. H. Thurston, Director of Sibley College, Cornell University, in his lecture before the graduating class of the Rose Polytechnic Institute, at Terre Haute, Ind., took for his subject the nation's great problem, the possibility of progress without revolution and without those periods of darkness and distress which have heretofore been its recording milestones. The solution of this problem he finds in education, the careful, moral cultivation of the people at large. There are, it is said, two distinct systems of education, the old or gymnastic, and the new or technical; but a deeper interpretation of the intellectual life shows no such distinction. However better adapted the new education may be to our present wants, it has at its foundation the elements of the old. The technical education, which is now beginning to receive proper recognition in our systems of culture, is simply the supplement to our older, incomplete academic training. In the ideal education, the citizen is fitted for the successful pursuit of every desirable object in life.

The education at school and college is no longer regarded as a finality, but simply as a means to an end, and that end is the student's life work and culture. Some years ago, in tracing the history of the development of the modern steam engine, Prof. Thurston divided its growth into three periods—speculation, application in several distinct forms, and, finally, a period of refinement.

In the growth of our educational systems, we have reached this third stage, the period of refinement, in which, the elements of the complete system being pres-

ent, it remains for us to select and arrange them to form a symmetrical whole of maximum efficiency, and adapted as perfectly as possible to the purposes which the experience and wisdom of the world have found essential. But the subject of technical education is so large that it has become necessary to specialize, and we have accordingly the manual training school, the trade school, and the school of engineering, in which the use of tools, their application in the arts, and finally the principles of design are respectively taught. By training each citizen to the greatest efficiency in his chosen work, it becomes possible to make our progress not only rapid, but, what is of infinitely more importance, continuous.

How to Cool a Cellar.

A great mistake is sometimes made in ventilating cellars and milk houses. The object of ventilation is to keep the cellars cool and dry, but this object often fails of being accomplished by a common mistake, and instead the cellar is made both warm and damp. A cool place should never be ventilated, unless the air admitted is cooler than the air within, or is at least as cool as that, or a very little warmer. The warmer the air, the more moisture it holds in suspension. Necessarily, the cooler the air, the more this moisture is condensed and precipitated. When a cool cellar is aired on a warm day, the entering air being in motion appears cool, but as it fills the cellar the cooler air with which it becomes mixed chills it, the moisture is condensed, and dew is deposited on the cold walls, and may often be seen running down them in streams. Then the cellar is damp, and soon becomes mouldy. To avoid this, the windows should only be opened at night, and late—the last thing before retiring. There is no need to fear that the night air is unhealthful—it is as pure as the air of midday, and is really drier. The cool air enters the apartment during the night, and circulates through it. The windows should be closed before sunrise in the morning, and kept closed and shaded through the day. If the air of the cellar is damp, it may be thoroughly dried by placing in it a peck of fresh lime in an open box. A peck of lime will absorb about seven pounds or more than three quarts of water, and in this way a cellar or milk room may soon be dried, even in the hottest weather.

Natural Gas at Findlay, Ohio.

At a recent meeting of the Ohio Gas Light Association, Springfield, O., Mr. E. B. Philipp, of Findlay, O., read a paper on the above subject, from which we take the following:

Somewhat more than a year ago our company (the Findlay Gas Light Company), which had supplied the city with coal gas for a period of ten years, was driven into the natural gas field on account of the formation of an opposition company. The result of the latter's test well, and the knowledge of the fact that its managers had secured a franchise, led us at once to drill for natural gas. A good flow was secured, and without any investigation as to its quality or nature, either by chemical analysis or through photometrical tests, we turned it into our holders and furnished it, in its crude natural condition, to our consumers.

The chemical analysis (kindly made for us by Mr. E. McMillin, of Columbus) is as follows:

Constituents.	Per cent.
Ammonia	0·00
Sulph. hydrogen	0·88
Carbonic acid	0·88
Bisulphide carbon	0·00
Illuminants	0·50
Oxygen	0·00
Carbonic oxide	2·00
Marsh gas (probably)	95·74

By passing the gas through lime-filled purifying boxes, and removing the carbonic acid and sulphureted hydrogen, we obtain a candle power of 13·77, a gain over best Argand showing on crude gas of 1·20 candles.

The best general lighting results are obtained when using burners rated to consume from 8 to 9 cubic feet per hour. At that rate of burning it gives a good and satisfactory light, excelling, in a number of instances, some qualities of coal gas. With this data before us, we may claim to have a fair quality of gas, above legal Ohio standard, which we furnish to our consumers at a very low price. Discarding the use of meters, we sell it by the tip or burner, charging from 15 to 30 cents per tip per month, according to the number of hours used.

This price is for flat flame and Argands. For regenerative burner consumption we charge more. At this price, estimating the average yearly number of burning hours at 1,400, with a consumption of 8 feet per hour, at an average cost of 20 cents per month, or $2.40 per year, we receive between 20 and 24 cents per thousand for our gas.

The present price of natural gas, as sold in Findlay, is lower than in any other town in the country, and by reason of the contention at the beginning. We furnish an ordinary house with fuel and lights for $30 or $35 per year; and hotels get fuel and light for about $240 per year. For our street lamps we receive $6 a year. The average price of gas to stoves, during the seven cold months, is from $1.50 to $2.50 per month. Occasional fires, or those lighted in upper rooms, such as bath and bed rooms, etc., are supplied for $1 per month. In summer we charge $1 per month for gas supplied to a cooking stove. For ordinary burners we get 15 to 30 cents per tip per month, according to size and number of hours used. For regenerative burners we get $1 per month.

A few facts of direct comparison between natural gas, as to relative cost, may be of interest from a financial standpoint: A dry goods store, where the coal gas bills formerly amounted to between $400 and $500 per year, is now lighted with natural gas at a cost of $144 per year. A saloon and restaurant, where the yearly coal gas charges were from $300 to $400, now pays $120 per annum for the natural gas. A private residence, where the coal gas bills formerly footed up to $30 or $35 per annum, is now lighted at a cost not to exceed $7 or $8 per annum.

In making these comparisons, it must be borne in mind, as no meters are used, that from 50 to 100 per cent more gas is now consumed than was the case when coal gas was used—the latter, of course, having been sold by the thousand cubic feet. On account of the non-registration plan the gas is used very lavishly, and without any regard for economy. Storerooms, where every economy was exercised in the use of coal gas, when they were only sufficiently illuminated to meet the absolute wants and requirements of business, are now a blaze of light. Private residences, which formerly had only a burner here and there, are now a blaze of light from cellar to garret. The street lamps, formerly lighted with 4 and 5 foot burners, are now lit up as if the town were illuminated for some special occasion. These facts and figures are practically of use in the solution of the problem as to the likelihood of natural gas becoming a competitor of coal gas as an illuminant.

One decided improvement in our present system might well be made. That is in the way of purification by lime, which process would remove the excess of carbonic acid and sulphureted hydrogen, thus increasing the illuminating power, and doing away with the sulphurous odors evolved in burning, and also materially helping the steadiness of the flame. This step of purification, however, while it would certainly benefit the gas as stated, is not now practical with us, on account of the size of our city. The consumer is unwilling to pay a cent more for it, should it be delivered to him in a purified state.

It has a tendency, however, to deposit a sort of white precipitate on the ceilings and walls of small rooms. It can be easily wiped off with a dry cloth.

One trouble with natural gas arises from the excessive temperature to which the rooms are heated. It is no unusual thing to experience a temperature of 75° or 80° in rooms lavishly illuminated and heated by natural gas. The people living in such warm rooms are liable to take cold when they go out into the open air; and the use of natural gas as a fuel may, for that reason, have a tendency to cause ill health. Physicians have paid much attention to this matter of sulphurous impurity in the air respired in apartments lighted by natural gas, but, as far as I know, they have not found it to be dangerous.

An Improved Electric Battery.

It is claimed for the electric battery invented by Mr. Upward, London, that it does away with nearly all the difficulties which have hitherto accompanied the employment of batteries, and has practically limited their use to purposes such as telegraph work, which requires but little energy. The constant addition of corrosive fluids, the amalgamation of the zinc, the rejection of spent liquids, and the clearing of porous pots, are alike avoided, and the only operations which are required in the battery itself are the addition of a little water from time to time, and the renewal of the zincs when they have wasted away. There is no local action, and the cells may be left for months without attention, and started again without any loss in the interval. The electromotive force is high, 2·1 volts, and is maintained constant, as there is no depolarizing fluid to become diluted and lose its power.

These advantages are due, says *Engineering*, to the use of a gas as the agent to convert one of the solid elements of the battery into a salt. The method by which this result is attained will be best understood by a description of the battery. The three elements are zinc, carbon, and chlorine. The zinc is contained in an inner porous pot, and is surrounded by a solution of chloride of zinc. The carbon is placed in the outer pot, and is partly in the form of hard plates, and partly in fragments. The latter are packed in to fill the entire space unoccupied by the plates, and are of such a size that the interstices between them afford ample passage for the chlorine gas, which is admitted near the bottom of the cell, and overflows near the top by a pipe leading to the next cell. The accumulation of liquid in the outer pot is prevented by an outlet near the bottom. A number of these cells are coupled together to form a battery, just in the usual way, with the addition that the outer cells, which are sealed at the top, are joined by pipes so that the gas can flow from the first to the second, and the second to the third, and so on to the last. As soon as the circuit is closed, the chloride of zinc solution in the porous pot is decomposed, molecule by molecule, the zinc passing through the earthenware jar to combine with the gas on the outer side, and the chlorine taking up another atom of zinc from the plate. There is sufficient percolation of water through the porous partition to wash the chloride of zinc out of the carbon and carry it away through the drip-cock at the bottom of the jar. This cock has a light water seal, to prevent the escape of chlorine or the admission of air.

The affinity existing between zinc and chlorine is sufficient to insure the circulation of the latter through the cells, and as each atom of chlorine disappears another flows in from the reservoir to take its place. But as the gas is seldom perfectly pure, and may contain air or other admixture, it follows that in time an accumulation of this foreign matter takes place in the last cell, and if not removed, would stop its action, and eventually produce the same result in each of the preceding cells. This difficulty has been got over by Mr. Upward by an ingenious arrangement of an aspirator, which comes into play whenever the electromotive force of the last cell falls a little, and continues in action until it has drawn out all the inert gas. The water tap of the aspirator, which is of the ordinary kind used in laboratories, is controlled by an electro-magnet, to which the current is admitted by a contrivance resembling a relay. This relay is worked by a current from the last cell, and makes the connection to the magnet as soon as the electromotive force falls sensibly.

It detracts from the great convenience of the new battery, that chlorine gas is not an article of commerce, and is scarcely likely to be. It must be produced on the premises where it is to be used, and its manufacture entails some little trouble, and, if not carefully conducted, may prove a nuisance.

The apparatus devised by Mr. Upward for the generation of the gas has been specially designed to avoid these inconveniences, and renders the operation as simple as it can be made. It consists of a short vertical cylinder or retort placed in a sand bath heated by a gas jet. Into this cylinder there is placed oxide of manganese, and then it is closed by a cover which dips into a water seal. Acid is run on to the manganese from a reservoir, and the gas evolved is led by a pipe to a holder constructed of earthenware pipes. As the gas is much heavier than air, it displaces the latter, and consequently there is no necessity for the use of a bell or of any moving parts in the holder. When the charge of manganese is spent, water is turned into the retort, and the liquid and gaseous contents are washed out into the drains. The lid is then raised, and the manganese, which is contained in an earthenware tray, is removed and replaced by a fresh quantity.

It is evident that this will be a cheap battery to work. There are no expensive materials used, such as nitric acid or bichromate of potash, and there is no waste from local action. What the exact expense is we are unable to say, and can only give the following figures, which are supplied by Mr. Upward, as a rough approximation. Chlorine gas costs from ½d. to 1d. per cubic ft., and the consumption of it in a battery applied to electric lighting with Woodhouse and Rawson's lamps is equal to 1 ft. per 30 candle-hours. The consumption of zinc is, of course, similar to that in any other battery having the same electromotive force, and the cost is about ¼d. per 30 candle-hours. Thus the expenses of the materials together amount to from ⅜d. to 1½d. per 30 candle-hours, or half that amount per lamp-hour. This makes no allowance for interest or depreciation, or for the renewal of lamps.

These figures show that the inventor does not put forward his battery as a source of energy which can vie in economy with a steam or gas engine in situations where these motors are admissible. But there are numerous places where the only sources of artificial light are lamps and candles, and for such situations this battery is a distinct improvement on its predecessors. In its mechanical features great care has been taken to render it as independent of attention as possible. The battery itself requires nothing but water, and even this can be admitted automatically by an apparatus acting on the principal of the bird fountain. The gas retort is made so large, that one charge of manganese will give a week's supply of gas, and this can be generated at one operation or more, according to the amount of acid admitted. The battery itself is kept at work all the twenty-four hours, and its current is received in an accumulator from which the lamps are fed. The loss in the accumulator is more than compensated for by the gain in working the battery under selected conditions, while the first cost is greatly reduced by this arrangement.

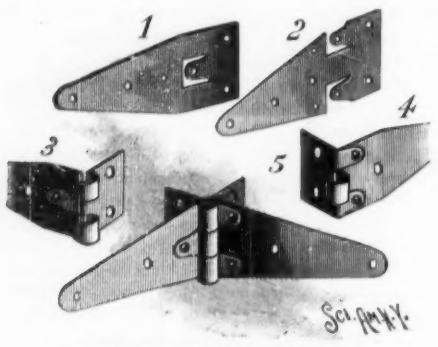
Keep on the Alert.

The manufacturer who hopes to hold his own in the fierce competition which characterizes modern industry must of necessity keep a sharp lookout for valuable improvements in machinery, and must introduce them promptly when they are presented. The movement of the industries is always forward. Thousands of ingenious minds are continually studying out methods for making processes easier and more economical. Every month some kind of a device for bettering the way of doing a thing, or for saving a little labor, is patented. The manufacturer who simply ignores these things, and runs along heedlessly in the old way, with the old devices, will be left behind and beaten as surely as the earth rolls around the sun. A mill built and filled with machinery twenty years ago, and left unimproved, could not begin to compete with a modern mill containing all the new mechanical improvements. And the way to keep a mill properly from deteriorating is to add every important improvement as it is put on the market. The most successful mills are the mills that do this very thing; and they succeed because they do it.—*The Cooper's Journal.*

IMPROVED HINGE.

One blank, Fig. 1, has a U-shaped slot forming a tongue, and the other, Fig. 2, has two L-shaped recesses in the side edges, forming two tongues at the sides. The first blank is then bent at right angles to form the two loops, Fig. 3, and a short wing at right angles to the long wing, the tongue being riveted to the latter. The second blank is bent to form one loop, Fig. 4, and a short and long wing, and its tongues are riveted as shown. Holes for nails or screws are provided in the wings. The two parts of the hinge are put together as shown in Fig. 5.

By making the tongues, waste of material in cutting or punching the blanks is avoided, and the sections are strengthened and stiffened at the angles.



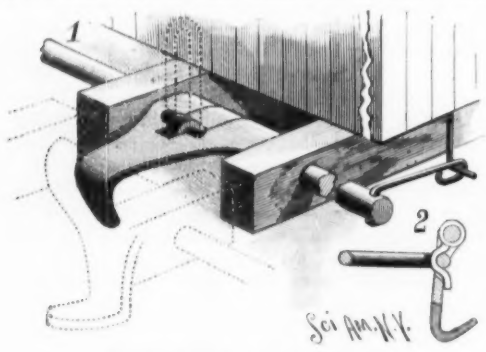
WHEELER'S IMPROVED HINGE.

Nails can be used for fastening the hinge as well as screws, as there is no strain in the direction of their length and they are not apt to be pulled out by the hinge. As each section has two wings, one wing can be fastened on the face of the door or window and the other on the edge.

This invention has been patented by Mr. Ferdinand Wheeler, of Pine Grove, Pa.

CAR COUPLING.

The car coupling herewith illustrated can be operated from the side of the car, thereby obviating the danger attending the coupling of cars in the usual way. In the buffers projecting from the end of the car frame is journaled a shaft which extends to the sides of the car. On the shaft between the buffers is secured a hook,

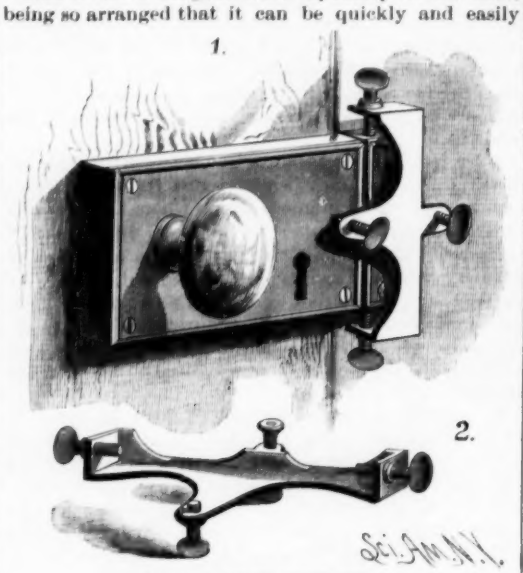


CARRUTHERS' CAR COUPLING.

shaped as shown in the cut. In a slot in the hook is an arm so arranged as to carry an ordinary coupling link, as shown in the sectional view and by the dotted lines in Fig. 1. In the ends of the shaft are holes to receive a rod formed with a loop at its free end, by which it is operated. In the side of the car is a hook for holding the handle rod in a horizontal position. When two cars provided with this coupling are brought together, the hook of one car is dropped over the body of the other hook, which hangs down as indicated by the dotted lines in Fig. 1. This coupler, which is the invention of Mr. G. F. Carruthers, of Winnipeg, Manitoba, Canada, can be made of rough material without any special finish; it requires but one hand of the train man to operate it, and it adjusts itself automatically to the vertical and lateral movements of the car.

DOOR SECURER.

This device is designed more especially for travelers, being so arranged that it can be quickly and easily



SIMON'S DOOR SECURER.

secured to the keeper of an ordinary lock, in which position it will effectually prevent the opening of the door from the outside. The attachment consists of a malleable iron plate formed with corner pieces and a central flange as shown in the cut. The attachment is held to the keeper of the ordinary form of rim lock by screws that pass through the end pieces. Passing through a projection in the middle of the side is a screw provided with a rubber buffer upon its inner end, which bears against the door casing; a screw passing through the inner edge of the plate strikes against the face of the lock, so that there can be no possible play between the attachment and the door, which cannot then be opened from the outside.

This invention has been patented by Mr. Michael Simon, of Millersburg, Ohio.

Ventilation by Flues.

The *Sanitary News*, of Chicago, having the inquiry if a bath tub, water closet, or sink connecting with a cesspool 30 feet away would be best ventilated if the ventilator pipe was run up through a chimney or along outside of it, submitted the communication to the Department of Health. Mr. De Wolf, the Commissioner, replies as follows: "If you mean to run the pipe into and up through the smoke flue, I unhesitatingly say, do not do it. First, because this permits the pipe to become unduly heated, thereby causing a very rapid upward movement of the air within the pipe, very often so rapid as to cause the entire sewage in the horizontal drain and connecting traps to become frozen in the winter months. Second, because of the destructive action upon iron pipes of sulphur compounds and other gases generated in the combustion of coal, which in a comparatively short time "honeycombs" or perforates the pipe, thereby permitting drain air to be discharged directly into the building during fluctuating currents (at times when flues are not heated). Third, because of the possibility, if not probability, of concealed work being imperfectly done. The best method is to carry the drain vent pipe outside of but near to a heated flue, and continue same to a proper distance above the roof of building.

Diversity of Opinion.

The *Pharmaceutical Record* says that editing a paper is a pleasant business—if you like it. But, like most other occupations, there are some annoyances.

If the type is large, it don't contain much reading matter.

If we publish many formulæ, says the editor, folks say they are not reliable.

If we omit them, we have no enterprise or are know-nothings.

If we have a few jokes, folks say we are rattleheads.

If we omit jokes, folks say we are fossils.

If we publish original matter, they scold us for not giving selections.

If we give selections, people say we are lazy for not writing more, and give them what they have not read in some other paper.

If we give a complimentary notice, we are censured for being partial.

If we don't, all hands say we are a great humbug.

If we remain in our office attending to our business, folks say we are too proud to mingle with other fellows.

If we go out, they say we don't attend to our business.

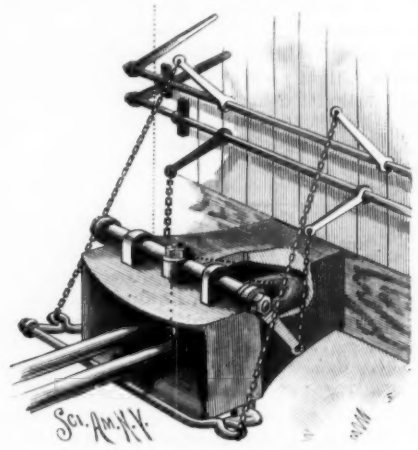
The Bicentennial Celebration at Albany, New York.

As July 22 will be the bicentennial of the incorporation of Albany as a city, very extensive preparations have been made for the commemoration of the event. Beginning on the previous Sunday with religious observances in all the churches, the entire week up to Saturday will be devoted to the celebration. An historical pageant, consisting of sixteen floats representing scenes in the history of Albany, and similar in character to those employed at the Philadelphia bicentennial and in the South during the Mardi Gras, will be a special feature of the occasion. The President, the Governor of New York, and other prominent officials will take part in the ceremonies.

CAR COUPLING.

The drawhead is formed with a deep link opening and with a vertical slot, whose rear walls are inclined. In the center of a rock shaft mounted in bearings secured to the upper face of the drawhead is a square hole to admit the end of the coupling pin, which is securely held by a nut screwing upon its projecting end. This construction provides for the easy renewal of the pin whenever necessary. On the ends of the shaft are arms connected by chains with lever arms on a shaft held on the end of the car and having arms at its ends.

By properly moving either of these arms, the pin can be swung up to the rear to permit the passage of the link. A link lifter, by means of which the link may be lifted to a position to enter the drawhead of the approaching car, is operated by chains leading to arms on a second shaft held in bearings on the end of the car. It will be seen that as the projecting end of the link enters the drawhead of the approaching car, the coupling pin will be forced back; and after the link has passed the end of the pin, the latter will drop to its normal position, and couple the cars. It is not necessary to enter between the cars, either to couple, uncouple, or guide the links properly.

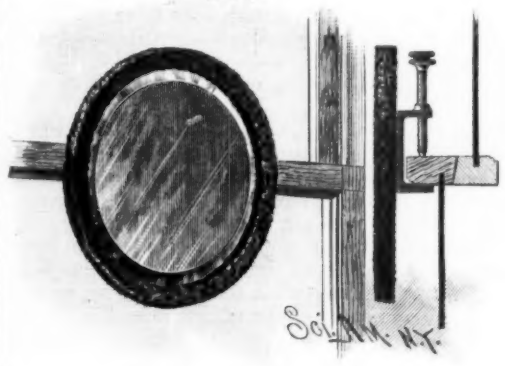


BRENNAN'S CAR COUPLING.

This invention has been patented by Mr. Matthew Brennan, of Louisville, Ky.

SHAVING MIRROR.

The convenient article herewith illustrated will be appreciated by all who make use of the razor. To the back of an ordinary mirror of any desired shape and size is secured a bracket, one arm of which is threaded to receive a screw, as shown in the small size view. One of the cross bars of a window is placed between the other arm of the bracket and the end of the screw, which is then turned so as to clamp the bar, thereby firmly holding the mirror in place. By this arrangement the glass can be placed in the best possible position as regards light, and can be quickly and easily brought into use or removed. The arms of the bracket are made long, and are at a sufficient distance apart to readily admit a cross bar of any depth or thickness.



PHILLIPS' SHAVING MIRROR.

This invention has been patented by Mr. S. A. Phillips, of 311 Church Street, New York city.

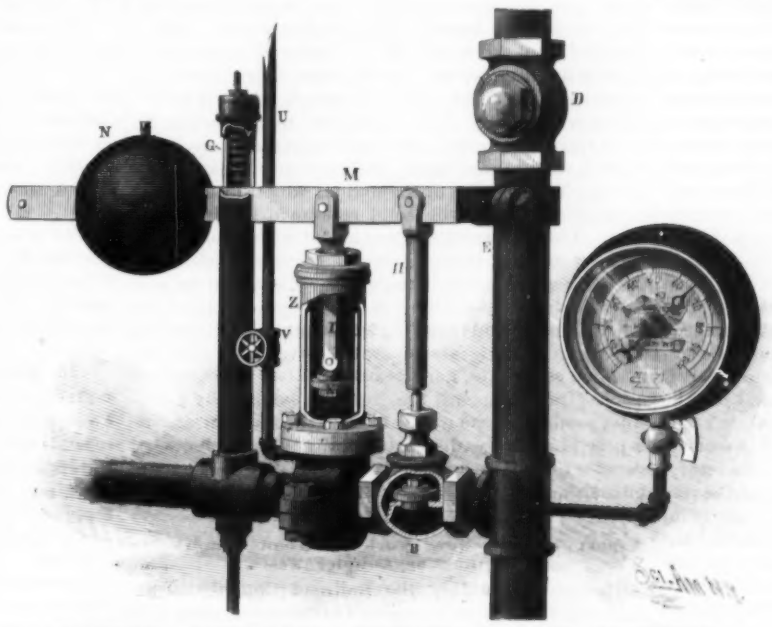
PNEUMATIC PRESSURE RELIEF GOVERNOR.

The design of this air governor is to meet a well known want, namely, that of relieving an air compressor, worked by belt power, or otherwise than with steam direct, from the power used in compressing the air, when it would otherwise compress more air than is wanted for working purposes, thereby saving all the power now expended in compressing such surplus air, which in many cases amounts to 50 or 75 per cent of the power really necessary.

This machine consists in having a branch pipe, O, attached to the upright or discharge pipe, E, in which pipe is a relief valve, B, which is operated by the rod, H, which is attached to the lever, M, to which is connected a piston rod, I, and piston, K, working in an air cylinder, Z. Also to the lower side of the cylinder is a pipe, U, and valve, V, which conveys the air from an air receiver into the air cylinder, Z; this air operates to raise the piston and lever, M, on which is a weight or ball, N, which is placed on the lever so as to balance the maximum pressure of air needed for the work to be done. The check valve, D, is placed in the discharge pipe, E, so that the compressed air shall not return and escape through the relief valve, B, when it is open.

The operation of the governor is as follows: When the compressor is at work, it forces the compressed air through the check valve, D, and discharge pipe, E, into the receiver, until the air is compressed to, say, one hundred pounds pressure per square inch. Now, this pressure applies (through pipe, U, and valve, V) under the piston, K, and this pressure is balanced by the weight, N, and lever, M; but when the pressure rises three or four pounds above the working pressure, it lifts the relief valve against the pressure on the relief valve and against the weight. When the valve is raised even a little, it exhausts the pressure on the top of the valve, and the air pressure in the cylinder, Z, being heavier than the weight and lever, it carries the valve wide open, and remains so until the pressure is reduced in the air receiver about three pounds, when the ball or weight, being the heavier, brings the valve to its seat again; thus it becomes a perfectly automatic pressure governor, and keeps the air steady within three or four pounds, the piston of the pump working at the same rate of speed all the time. In this way, very many compressors may be worked by power, without using any more power than what is necessary to compress the air required.

This governor is the invention of Mr. James Clayton, whose works are at 45 and 47 York Street, Brooklyn, N. Y., and whose New York office is at 43 Dey Street.

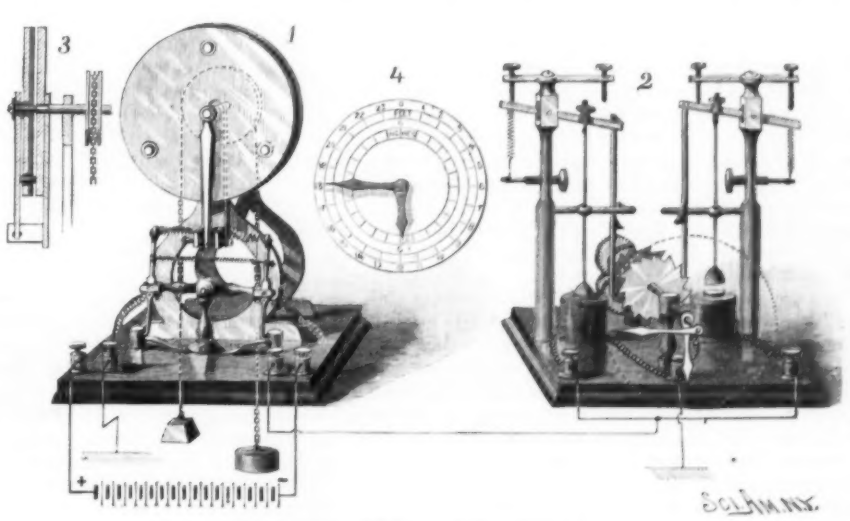


CLAYTON'S PNEUMATIC PRESSURE RELIEF GOVERNOR.

WATER LEVEL INDICATOR.

This instrument is intended for indicating the level of water at a distance. Fig. 1 is a perspective view of the electro-mechanical transmitter, Fig. 2 shows the receiver with the dial removed, Fig. 3 is a vertical section through the transmitter, and Fig. 4 is a detail view of the dial and indexes. On a shaft journaled in standards secured to the base of the transmitter is a wheel over which passes a chain having at one end a float and at the other end a counterbalance weight. When the water in which the float rests rises, the float is raised and the shaft turned by the chain. This movement, through the intermedium of suitably arranged levers and springs, permits the current from the battery to pass to the line in one direction and to the ground in the other. A further turning of the shaft, caused by continued rising of the water, produces a series of electrical impulses upon the line wire, which are all in one direction, and affect only one of the magnets of the receiver. Each electrical impulse corresponds to the rise of the float through the space of one inch, and each impulse draws down the armature belonging to the magnet, thereby indicating by means of an index, Fig. 4, a rise of one inch. The reverse motion of the shaft caused by the water falling so operates the levers as to reverse the current along the line. This reversed current will not affect the first magnet, but will be effective in operating the second magnet, whose armature will then act upon the recording mechanism to diminish the amount indicated by the indexes. In this manner the level of the water is always indicated by the indexes in connection with the dial.

The helices of the magnets being of equal resistance, the current from the line is divided at the receiving instrument into two equal parts; this results in the temporary demagnetization of one of the magnets and the augmentation of the power of the other, so that each magnet is rendered effective by the current suited to it. In addition to its use as a water level indicator, this instrument may be used to indicate the height of a gasometer or the distance traveled by any moving object, either in a horizontal or vertical direction.



WATER LEVEL INDICATOR.

This invention has been patented by Mr. Wilbur S. Mayers, of Fort Apache, Arizona.

The Young Father's First Telegram.

It is great fun to watch the senders of these first baby dispatches as they prepare them. A young father comes in with a hurried step and an exultant, beaming face. He grasps the blank, and dashes off something like this: "Great news! Mary very ill! Fine boy!"

Then he tears that up. Somehow he doesn't want the rude telegrapher to know the name of the helpless but happy sufferer, and he tries it again. "Expected event realized; a little girl; wife doing well." "But, pshaw!" he says, "that's rather a cold way to speak of her to her own father and mother. Wife—why, of course she's wife, but I don't like that," and he tears it up. Then he starts again, and this time he says, "Confound the telegrapher! He shan't know anything about it;" and he writes, "It has come—eight pounds—female; mother all right." He looks at it a minute and tears it up, with the remark, "They don't know whether that means a Jersey calf or a Hambletonian colt." By this time the young man has got into a sweat, and grabbing a pencil he dashes off, "It's a girl. Mother doing nicely," and after looking at that five or six minutes, and it may be with a moistened eye, he signs his first name to it and hands it in. They're proud and happy and conscious, and yet they will do almost anything to conceal their identity.

Sometimes the young man comes in showing signs that the great domestic event has been too much for him, and then I have to take the pencil and help him out, and I do it in a practical way. I get the address and I simply write, "The little stranger is here. It is a girl (or boy). Mother well;" and then the man pays over his half dollar, and nearly pulls me through the window in his fierce desire to go and give the baby a bath.—*Journal of the Telegraph.*

Mounting the Lick Telescope.

The trustees have awarded the contract for mounting the 36-inch objective (now in the hands of the Messrs. Clark, of Cambridgeport) to the firm of Warner & Swasey, Cleveland, Ohio, for the sum of $42,000. Messrs. Warner & Swasey were successful in a competition which included most of the celebrated makers of the world. One firm of celebrated makers (the Repsolds, of Hamburg) declined to compete on account of the short time available for the purpose. The mounting proposed by Messrs. Warner & Swasey will include every one of the improvements which have been lately introduced into the mountings of large telescopes, with the addition of one or two improvements peculiar to themselves.

The telescope is to be 57 feet long; the diameter of the tube is 42 inches. The tube is suspended at the middle, and the point of suspension is to be 37 feet above the floor of the dome. The axes on which the tube moves are supported by a heavy iron column, 17 × 10 feet at its base.

Provisions are made by which it is possible for an observer at the eye end of the telescope to command all the possible motions, and these same motions can also be controlled by an observer stationed on a small balcony 20 feet above the floor. It is expected that, in spite of the great size of the telescope itself and of its great weight, the mechanism will be so delicately adjusted as to render the use of power unnecessary.

Messrs. Warner & Swasey are to have this mounting completed in April, 1887, and some time during the summer of 1887 the glass will be brought to Mt. Hamilton, where the mounting will already have been erected under the great dome, now building at the Union Iron Works, San Francisco, so that one may look forward to the completion of the Lick Observatory some time during the next year. It is impossible without an accurate description to give any complete notion of the excellence of the provisions which have been made by the Lick trustees. A rough idea may be had by considering the cost of the various parts of the great telescope, dome, mounting, etc.: Cost of the dome, $56,850; cost of the mounting, $42,000; cost of the visual objective, $53,000; additional cost of the photographic objective, $13,000; total, $164,850. Besides these sums, several thousand dollars will be required to put the instrument into its final completed state.

The Buffalo Carpet Beetle.

T. W. S. says: Please inform me what way I can best get rid of a great pest, the carpet moth. It is about the size of a grain of wheat, is black, and has hair on it like a caterpillar. It will run backward as well as forward. The carpet moth, of which our correspondent complains, is in all probability the so-called "buffalo moth" (*Anthrenus scrophulariæ*), which has previously been figured and described at length in the columns of the SCIENTIFIC AMERICAN. Prof. L. O. Howard, Assistant in Charge of the Division of Entomology, Washington, says: "Where this insect is discovered in a carpeted room, the carpet should be taken up and sprinkled with benzine, and this substance should be poured into the cracks of the floor and under the base-boards. After airing both the room and the carpet, to get rid of the disagreeable odor, strips of roofing paper (prepared with gas tar), about two feet in width, should be spread around the edges of the room, and the carpet should be tacked down over them."

IMPERVIOUS CORKS.—Corks may be made impervious by soaking them—best quality—for several hours in a solution of one-half ounce of glue or gelatine in a mixture of three-fourths ounce of glycerine and one pint of water, heated to a temperature of about 50° C. Such prepared corks may be rendered nearly proof against acids and other chemicals if they are dipped, after thorough drying, for ten or fifteen minutes into a melted mixture of four parts of paraffine and one part of vaseline.

The Inventor of Saccharine.

A representative of the *American Analyst* called upon Dr. Constantine Fahlberg, the inventor or discoverer of saccharine, the new coal tar sugar, and had a long talk with him about his new discovery. The doctor is a tall, well built, handsome German-American of about thirty-eight years of age. He speaks the modern languages fluently, and, despite the celebrity that has so suddenly fallen upon him, is quite diffident and reserved.

"How did I discover saccharine?" he said. "Well, it was partly by accident and partly by study. I had worked a long time upon the compound radicals and substitution products of coal tar, and had made a number of scientific discoveries that are, so far as I know, of no commercial value. One evening I was so interested in my laboratory that I forgot about supper until quite late, and then rushed off for a meal without stopping to wash my hands. I sat down, broke a piece of bread, and put it to my lips. It tasted unspeakably sweet. I did not ask why it was so, probably because I thought it was some cake or sweetmeat. I rinsed my mouth with water, and dried my mustache with my napkin, when, to my surprise, the napkin tasted sweeter than the bread. Then I was puzzled. I again raised my goblet, and, as fortune would have it, applied my mouth where my fingers had touched it before. The water seemed sirup. It flashed upon me that I was the cause of the singular universal sweetness, and I accordingly tasted the end of my thumb, and found that it surpassed any confectionery I had ever eaten. I saw the whole thing at a glance. I had discovered or made some coal tar substance which out-sugared sugar. I dropped my dinner, and ran back to the laboratory. There, in my excitement, I tasted the contents of every beaker and evaporating dish on the table. Luckily for me, none contained any corrosive or poisonous liquid.

"One of them contained an impure solution of saccharine. On this I worked then for weeks and months until I had determined its chemical composition, its characteristics and reactions, and the best modes of making it scientifically and commercially.

"When I first published my researches, some people laughed as if it were a scientific joke, others, of a more skeptical turn, doubted the discovery and the discoverer, and still others proclaimed the work as being of no practical value.

"When the public first saw saccharine, however, everything changed. The entire press, European and American, described me and my sugar in a way that may have been edifying, but was simply amusing to me. And then came letters. My mail has run as high as sixty a day. People wanting samples of saccharine, my autograph, or my opinion on chemical problems, desiring to become my partner, to buy my discovery, to be my agent, to enter my laboratory, and the like.

"What have I done? I have started a company in Germany to manufacture saccharine, with a capital of 2,000,000 marks. They are already at work, and are now producing the new sugar. It costs, or rather we sell it, between $10 and $12 per pound, but will reduce these figures considerably before a year has gone past. I would rather have started in this country, which is my home, but the high price of skilled labor, and the high tariff on the crude materials (fine chemicals) of which saccharine is made, deterred me and my friends from so doing. I will say, however, that if applied chemistry continues progressing as it has done in the past decade, we shall open branch works here within the next five years."

Saccharine is proving a wonderful success. It is used already in many ways. Prof. Leyden, of Berlin, recommended it to sweeten fine wafers and other foods for invalids, and wrote a formula for it in such cases. This is used by bakers and confectioners, and more especially by Mannl & Co., the great wafer manufacturers of Carlsbad, Bohemia. It is also employed by the makers of glucose and beet sugar. These are inferior in sweetness to cane sugar, but superior in digestibility and healthfulness. The addition of a trifling fraction of saccharine makes them the equals of the finest cane sugar in the market. Saccharine is so sweet that a teaspoonful converts a barrel of water into sirup. A small wafer of it converts the bitterest quinine solution or acid drink into a regular molasses. It will therefore be invaluable in disguising and destroying all the bitter and sour tastes in medicine without changing the character or action of the drugs.

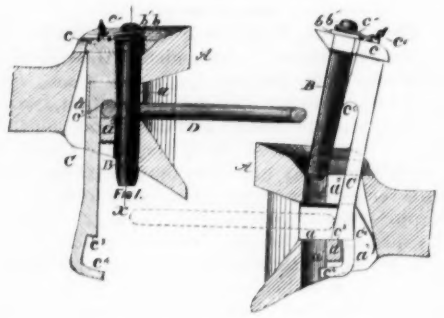
Saccharine does not decay, mould, or ferment, neither is it attacked by bacteria. It has no injurious effect upon the human system. What effect has been noticed is rather beneficial than otherwise. This immunity from decay will render it of great utility in pickling and preserving delicate vegetables and meats. Where sugar is used as a flavor and not as a food, there, I think, it is bound to be replaced by saccharine; where as a food and flavor combined, it will not be. In the future the new sugar will be used by druggists, physicians, bakers, confectioners, candy makers, preserve and pickle makers, liquor distillers, wine makers, and dealers in bottlers' supplies.

THE FORMATION OF SACCHARINE.

The new coal tar product, saccharine, which is expected to prove very useful on account of its sweetening power—in respect of which it stands to cane sugar in the ratio of 220 to 1, and with which considerable antiseptic properties are combined—was mentioned at length by Sir Sydney Roscoe in a recent discourse at the Royal Institution. This new substance was described by the lecturer as perhaps the most remarkable of all the marvelous products of the coal tar industry. It is not a sugar, but contains carbon, hydrogen, sulphur, oxygen, and nitrogen; and its chemical name is benzoyl sulphuric imide. It is neither a nutrient nor a poison. It is derived from the toluene of coal tar, by a process comprising at least seven distinct steps; the whole contributing a triumph of synthetical chemistry. Toluene is first heated with sulphuric acid of 168⅕° Twaddell, but not above 100° C. After all the original toluene has disappeared, the mixture is run into wooden tanks partly filled with cold water, where it is stirred up with chalk. The mass thus neutralized is filtered through a press; and the calcium salts are treated with sodium carbonate, with another filtration following. The solution of the sodium salts thus obtained is evaporated, and the solid residue dried by steam heat. This material is then mixed with phosphorus trichloride, and treated with a current of chlorine. Certain residuals are then driven off, and the apparatus contains two sulphonic chlorides—one solid and the other liquid. Only the latter is capable of yielding saccharine. This is now separated, mixed with solid ammonium carbonate, and steamed. After some further mechanical treatment, the liquid is oxidized by potassium permanganate; and, finally, the pure saccharine is precipitated by dilute mineral acids. It has a far sweeter taste than sugar, and a faint, delicate flavor of bitter almonds.

Report of the New York Railroad Commission on the Car Coupler Tests.

On the 7th of July the Railroad Commission announced its decision in regard to the car-coupling tests made at East Albany last month. They award the first place to the Hoag coupler. This is an invention not in use on any railroad at present. It is the work



of C. M. Hoag, of Greenbush, an engineer on the Boston and Albany Railroad. At the trial it was the only one that made the "flying switch" automatically. In its normal condition the link is level, and works successfully on all cars. The recommendations of the commission, which are the most important made since its organization, are as follows:

First.—That the standard height of drawbar of the Master Car Builders' Association, viz., 2 feet 9 inches from top of rail to center of drawhead, when the car is empty, be adopted by all railroad corporations; that new cars be made to conform thereto, and that old cars, when repaired, be made to conform as nearly as possible.

Second.—That all freight cars not having platforms be equipped with "deadwood" blocks to conform to the standard of the Master Car Builders' Association.

Third.—That a standard link be adopted of 10½ inches inside measurement and 13 inches outside measurement.

Fourth.—That all existing link and pin drawheads be provided with a stop in the throat to prevent a link entering more than 7 inches

Fifth.—Of the couplers presented to be tested on the 16th and 17th of June, the board finds the following to fulfill the requirements of the law. There are many others of which the board has drawings or models, and which possess merit, but as to them the board makes no mention for the reasons, first, that cars were not equipped with them; and, second, that little weight can be given to the workings of a model alone. Those practically tested are divided, first, into classes mentioned in what the board regards as the order of merit; second, each coupler is mentioned under its class, in what the board regards as its order of merit.

First Class, A—Link and pin couplers, pin held up by catch or "dog." The "dog" is thrown back by a link entering and allowing the pin to drop automatically; uses standard link, and couples automatically with the old drawbar of stop in throat, or B, beveled pin permitting link to slip under. Hoag, McKeen, N. Barr, Perry, United States, Robinson, Keeler, Sherman, Thurber, Whitman, Kilmer beveled pin, Wilson beveled pin.

Second Class—Vertical hook and link, link pushed on to hook, couples automatically with old drawbar of stop in throat. Archer, Aikman, Marks, Smith, Baldwin, Fennell.

Third Class—Janney, Barnes, Cowell, Thurmond, Dowling, Heim, Titus & Bossinger, Boston automatic, Lorraine.

Fourth Class—Ames, Custis & Wood, Adams, Felthausen, and Lawtenslager.

We give herewith a sketch of the Hoag Coupler which was patented July 15, 1884.

The following are the patentee's claims:

1. In a car coupling, the combination, with a drawbar head, A, provided with recessed opening, *a*, a vertical opening, *a'*, having the vertical mortise, a^2, opening thereinto, and the bridge bar, a^3, all as herein described, of the carrier, C, adapted to contain a removable coupling pin, B, and provided with shoulders, *c'* and c^3, and hook, c^4, all being constructed and arranged to operate as and for the purpose herein specified.

2. In a car coupling, the combination, with a separate coupling pin, B, of the carrier, C, having the yoke, c^1, jointed thereto, the said yoke being adapted to engage with the coupling pin, B, in the manner and for the purpose herein specified.

Electrical Subways for New York.

The special commission of which Mr. Roswell P. Flower is president, authorized by the State Legislature for the purpose of carrying out the provisions of the statute requiring all telegraph, telephone, electric light, and other special wires to be laid underground, reported on the 30th ult. their proposed plan, which, when approved by the Attorney-General, will be adopted. The report favors what is termed the "drawing-in" system, in other words, the laying of a large pipe underground, provided at frequent intervals with convenient manholes. The wires are drawn in through these, and spliced as required.

Iron pipe was found to be objectionable, since it would rust and corrode, and at the same time furnish a ground in case a wire was accidentally broken.

A pipe composed of asphalt and gravel is recommended, first because it is much cheaper than iron, is easily moulded to suit different curves, and second because it is of itself a non-conductor of electricity, steam, or gas, is non-corrosive, and can be made waterproof.

The following are the conditions adopted by the Commission respecting the manufacture of the pipe:

Its material shall be an asphalt or bituminous concrete which shall be capable of sustaining the following tests: It should sustain a crushing test of 4,000 pounds per square inch, and have a tensile strength of not less than 300 pounds per square inch of section; it should not crack when subjected to a temperature of 10°, or lose its shape at 200°; it should not soften below 160°; it should resist the action of organic acids and illuminating gas, and should not disintegrate under the action of salt water; the pitch or asphalt used should be inspected before it enters into the concrete, and be pliable at 150°, but brittle below that temperature. It should not be heated above 325° in boiling; the sand used should be silicious, and the porosity of each lot carefully determined, so as to insure the perfect cohesion of the mass, with no excess of plastic material. But this shall not prevent the use of any other material where the special exingencies of particular electrical services or of particular localities render it advisable in the opinion of the Commission. Its form shall in general be that of a conduit, with convenient manholes, where cables and insulated wires may be readily drawn in and out of distinct ducts in the conduit; but this shall not prevent the laying of wires in other ways, where for special reasons it may seem desirable to the Commission.

Mr. Henry S. Kearney was appointed associate supervising engineer.

It is expected districts will soon be mapped out, and a system perfected for carrying out the work. It is proposed to let the work out to a special construction company, as the Commission has no funds for constructing and laying the pipes.

Annual Convention of Photographers.

One thousand photographers, from all parts of the United States and Canada, were present at the seventh annual convention of their association, recently held at St. Louis. Many foreign artists who were not able to attend personally sent specimens of their work as representatives. An interesting feature of the convention was the exhibition by the various photographers of many views taken in the United States, Canada, England, and Germany. These included an almost infinite variety of subjects. They covered all the available space on the walls of the hall used for the daily sessions, as well as fourteen small adjacent rooms and five thousand square feet of partitions, which were specially erected for the purpose. There was also on display a most complete exhibition of all apparatus known to the art.

Correspondence.

Centrifugal Casting Process.

To the Editor of the Scientific American:

Plain cylinders, sections of pipe, or any straight tube form may be cast by this process, without using cores and with proper attention to keeping everything true, level, and well balanced; and by close skimming or tapping instead of pouring, the melted metal will produce castings which for many purposes will not require to be bored out. The flask will be a hollow metal drum, divided lengthwise into two halves, and provided with hollow trunnion bearings at each end, to one of which will be attached a driving pulley. The outside form of the cylinder or pipe to be cast will be moulded in the usual manner in this flask, the two halves bolted together, and the drum made to revolve with a speed somewhat greater than is necessary to overcome gravitation. The melted metal will be introduced through the hollow end bearings in amount proportioned to required thickness of the shell or walls of the casting, the end openings closed to keep out cold air—all while the drum is in motion—and regular rotation continued until the metal is sufficiently cold. The ends of the drum should be protected by a non-conductor of heat or externally heated a little, that the casting may not be distorted from the ends cooling more rapidly than the central portions. As a patent this is worthless, but as a useful process it will be of some value to the few who find use for it. An experiment is worth the trial by any one who has facilities for trying it—for, as yet, it is wholly unproved; but that it will work all right and come into use is the opinion of

W. L. DAVIS.

How to Set a Slide Valve.

To the Editor of the Scientific American:

I see in an old number of SCIENTIFIC AMERICAN, under heading "How to Set a Slide Valve," a long and tedious, though tolerably accurate, method of adjusting a slide valve described.

Since the crank, flywheel, main shaft, dead center, or connecting rod has nothing to do with the accurate setting of a slide valve, I will offer you the following very simple and quick method of performing that little piece of work to a nicety.

After having removed lid from steam chest, revolve the main shaft, or slack the set screws in eccentric, and revolve eccentric until full throw of same is made in one direction, opening the port to its largest size. Now make a nice, even-tapered wedge out of a lath and slip it down in open port, marking with a knife or sharp pencil the edge of wedge on valve seat. Now revolve eccentric until full throw is made toward opposite end of steam chest and until port is opened to its largest size, then slip the wedge down in port, as before, marking on valve seat as before; then with a carpenter's rule divide the distance between the two lines on edge of wedge, making a third line in the center. Then with eccentric at full throw lengthen or shorten the cam rod until wedge, with its center line, fits one port *neatly*, and it will fit the other one as neatly when full throw is made in opposite direction.

Now place your engine on a center, and revolve eccentric until the port over the end of cylinder in which the follower is placed has opened about one-sixteenth of an inch, and tighten your set screws. This done, your slide valve, also your eccentric, is properly adjusted, and no time wasted in hunting dead center or chalk marking flywheels, etc.

WILLIAM R. DUNN.

Alton, Ind., June 19, 1886.

The Edinburgh Exhibition.

The collection of exhibits sent from the Fairfield Shipyard and Engine Works is the most extensive and the most varied in this department of the exhibition. The interest attaching to most of the Fairfield exhibits is very great. It is probable that the most attractive object among them is the full model which is shown of the yacht Livadia, built a few years ago for the Emperor of Russia, and perhaps the most remarkable vessel ever launched.

In one of the Fairfield Company's cases there is shown a full model of the famous Alaska, whose performances as a Liverpool and New York liner in the Guion Company's service are notorious. As our readers are well aware, she has performed a number of very fast passages, one of them being done in six days eighteen hours. The model of the Alaska is really a beautiful piece of art workmanship. Close beside it there is an equally fine full model of the North German Lloyd's steamer Adler, one of the three sister ships now being completed at the Fairfield Works. All three vessels are fitted with all the most modern improvements, including triple expansion engines of 7,000 indicated horse power, and the Bryce-Douglas valve gear. The engines in question are the largest of the triple expansion type yet afloat, and the first that have yet been fitted into any of the New York passenger liners. We may mention incidentally that the valve gear of Mr. Bryce-Douglas is now exciting much attention among marine and locomotive engineers, especially in the northern part of the kingdom, and that it has been adopted in the locomotive engine which Messrs. Dubs & Co. have built for the Caledonian Railway Co., and which forms a conspicuous object in the central avenue of the exhibition. This engine we shall shortly illustrate. The same gear is also being adopted by Mr. D. Drummond in half a dozen locomotives which he is building for the same company, in their own works at St. Rollux, Glasgow. There are many other highly interesting exhibits at the Fairfield Company's stand (No. 786), which we cannot detail at length. Among them we notice photographs of six sets of engines, which were in course of construction at the Fairfield Engine Works in August, 1884, and comprising a total of nearly 40,000 indicated horse power. Another is a half model of the famous China tea clipper steamer Stirling Castle, which was built for Messrs. Thomas Skinner & Co., attained a speed on trial of 18½ knots per hour, and made the fastest passage on record with tea from China, doing the run from Woosung to the Isle of Wight in the unprecedented time of 29 days 11 hours. Of course, as Fairfield is famous for turning out some excellent examples of war ships for the British Government, the company's exhibits at this stand include at least two illustrations, more especially the twin screw armorclad Nelson and the vessels of the Comus class. We ought not to omit to refer to the half model of the twin screw barbette cruiser, which the Americans call the Destroyer, a vessel of 10,500 tons displacement, measuring 410 ft. by 64 ft. 3 in. by 38 ft. 6 in., and intended to have a speed of 21 knots per hour, her armament including two 110 ton guns and eight 6 in. long range guns.—*Engineering.*

The Delicacy of the Sense of Smell.

The sense of smell is probably the leading sensorial endowment in most insects, and it does for them what sight and hearing do for man. Its potency in helping along intelligence is very great, since we know that, mentally, insects stand at the head of the invertebrate, as man stands at the head of the vertebrate, world. The sense of smell is probably acute in some fishes, as, for example, the shark; this is the most active, if not the most intelligent, of fishes, and it has an olfactory mucous membrane which, if spread out, would cover some twelve square feet. The sense falls in value in the amphibia, reptiles, and birds, but rises again in the mammalia, though not in proportion to intelligence. Its extreme acuteness in the dog, the most intelligent of animals short of quadrumana, is well known. In man, the sense of smell is subordinate, and even rudimentary. Olfaction adds to man's enjoyment, preserves him from some dangers, but does not very much extend his knowledge of his environment.

Yet, despite the comparative insignificance of this sense in man, its delicacy is most marvelous, and by it we can appreciate more minute subdivisions of matter or the impact of more infinitesimal molecular vibrations than by any other of the avenues to the brain.

Professor Valentine has made some interesting and striking experiments in proof of this. He found that a current of air containing 1-30,000 milligramme of bromine, or 1-500,000 milligramme of sulphureted hydrogen, or 1-2,000,000 milligramme of oil of roses, could be perceived by the sense of smell. He also determined that the amount of odoriferous air which must pass over the olfactory membrane in order to excite the sense of smell was from fifty to one hundred cubic centimeters (one-tenth to one-fifth of a pint). He calculated, therefore, that the actual amount of bromine necessary to excite a sense of smell was 1-600 milligramme, of sulphureted hydrogen 1-5,000 milligramme, of oil of roses 1-20,000 milligramme (about 1-120,000 of a grain).

Two recent experimenters, E. Fischer and F. Pentzoldt, of Erlangen, have found two other substances which far exceed the foregoing in their capacity for affecting the olfactory nerves. These were mercaptan (sulphureted alcohol) and chlorphenol. They found that in air containing 1-230,000,000 milligramme to the cubic centimeter of chlorphenol, and 1-23,000,000,000 milligramme of mercaptan, these substances could be appreciated, and it was estimated that only 1-4,600,000 milligramme of chlorphenol, and 1-460,000,000 milligramme of mercaptan, is necessary to excite a sensation of smell. There exists, therefore, a substance which in so small a subdivision as 1-2,760,000,000 grain, or not quite one three-billionth of a grain, is capable of calling out a nerve impulse. This subdivision of matter is quite beyond comprehension, yet the nose alone can appreciate it. The smallest subdivision appreciable by the eye through the spectroscope is 1-1,400,000 milligramme of sodium, which is a two hundred and fifty times coarser division of matter than the minimum of odor-exciting mercaptan.

On account of the extraordinary power of mercaptan it is proposed to put it to some practical use in testing currents of air, ventilation, etc.—*Medical Record.*

On the Place of Origin of Uric Acid in the Animal Body.*

The endeavor of the author in this communication has been to show the place of origin of uric acid in the animal body, and to ascertain which of the two hypotheses on the subject is correct, viz., whether uric acid is first present in the blood, and then secreted from the blood by the kidneys, or whether it is formed by the kidneys themselves. To enable him to satisfactorily prosecute many of his observations, the author has devised a new method for discovering the presence of uric acid in very minute quantities of blood.

The results of his investigations are embodied in the form of the nine following propositions:

Prop. I.—Uric acid is secreted by the kidneys as ammonium urate; and in the case of birds and reptiles, whose urine is semi-solid, it is found in a definite physical form, more in the vitreous condition than in the truly crystalline shape.

Prop. II.—Uric acid, when present in the blood, is found under the form of sodium urate; and, when deposited from the blood during life in any tissue, it is also as sodium urate in its characteristic crystalline form.

Prop. III.—The daily quantity of uric acid in relation to their body weights secreted by different animals varies extremely. In some, as the carnivorous mammalia, the ratio may be less than 1 to 1,000,000, whereas in others, as birds, it may be as 1 to 85. In man it may be regarded as about 1 to 120,000.

Prop. IV.—The quantity of uric acid contained in the blood of different animals has little relation to that secreted by the kidneys. In birds, secreting daily so large a quantity, the blood is often found to be as free from uric acid as it is in animals whose daily elimination of uric acid is excessively small.

Prop. V.—When uric acid is absorbed from the alimentary canal, the blood becomes strongly impregnated, and, in fact, often almost saturated with it, so that its presence is readily discovered by any ordinary test.

Prop. VI.—One cause of the appearance of an unusual quantity of uric acid in the blood of birds in health is the presence of uric acid in the water they drink, and occasionally in their solid food.

Prop. VII.—When uric acid is taken into the stomach of man or other animals, the secretion of this principle from the kidneys is not increased, although at the time the blood may be rich in it.

Prop. VIII.—Uric acid is found in varying quantities in the blood obtained from different veins in the same animal. It is found in larger quantity in that from the efferent renal veins than in that from the portal afferent, or from the jugular veins; and the same test which freely exhibits uric acid in the blood from the former often fails to show it at all in that from the latter two.

Prop. IX.—The quantity of uric acid secreted daily by the kidneys of a bird is in close relation to the quantity of nitrogenized food taken during the time.

Having brought forward proofs to confirm these propositions severally, the author draws the following conclusions, viz., that every argument is in favor of the hypothesis that uric acid is formed by the kidney cells, in the form of ammonium urate, and that the traces of sodium urate found in the blood are the result of a necessary absorption, slight in amount, of the ammonium urate from the kidneys into the blood, and its subsequent conversion in that fluid into sodium urate.

Magnesia in Portland Cement.

For a long time, magnesia has been supposed to have a bad influence when present in cements, and M. Lechartier has been investigating the nature and cause of its action in structures built with cement, such as basins, dams, and retaining walls, either exposed to air or water. These structures were built by competent engineers in different localities. The cements used did not contain sulphate of lime in a harmful proportion, they had a proper density, and were made of good sands. Nevertheless, in all cases the effects were the same, and a slow destruction of the cement went on with time. The explanation of the facts arrived at by M. Lechartier is that the cements employed were really mixtures of Portland cement with magnesia, which behaved at first as an inert substance; but little by little the magnesia became hydrated, producing expansion of the mortar and the deterioration of the works. St. Clair Deville has shown that pure magnesia without admixture of silica and alumina can combine with water to form a hydrate of great hardness, but the formation is accompanied with increase of volume. Portland cement alone contains but a small proportion of magnesia. M. Lechartier further observes that the increase of volume of the mortars takes place more rapidly when the water gains access more readily to the mass. Hence the basins of fountains, reservoir walls, and so on, are affected in a comparatively short time.

* Abstract of a paper read before the Royal Society, June 10, 1886, by Alfred Baring Garrod, M.D., F.R.S., as reported in the *Chemical News.*

COLLISION BALLS AND HARMONIC IMPACT.

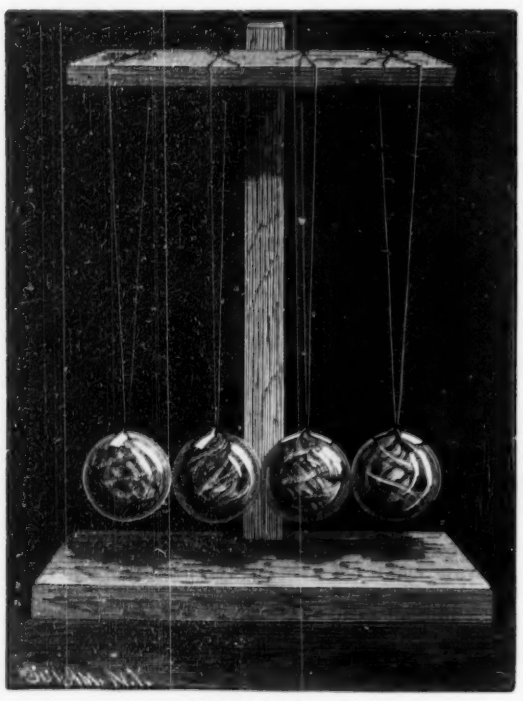
BY T. O'CONOR SLOANE, PH.D.

The laws of the impact of elastic bodies are very nicely illustrated by collision balls. As bought in the stores, this piece of apparatus is quite expensive. In the cheaper grades, the spheres are made of lignum vitæ, which are too light and not sufficiently elastic. The higher priced ones are made with ivory spheres, and these naturally are better. But either kind is unsatisfactory. The first quality required is a high coefficient of restitution of impact, or, as it may be more concisely expressed, a high degree of elasticity of impact. A body may be very elastic in one way, that is to say, it may recover its original figure after distortion perfectly, yet may not recover it quickly enough to possess the desired property. The next quality required is high specific gravity. Wood is so light that the resistance of the air affects it. The best substance for these balls, all things considered, is glass. Glass marbles are sold in the wholesale toy stores, of various sizes up to two inches in diameter. Six of these are enough for all purposes. They can be purchased at so low a price as to bring the cost of the apparatus down to a nominal amount. It is well to have one small one, half or three-quarters the diameter of the others. They have first to be prepared for suspension.

A hole may be readily drilled in each one by using a hard drill kept moist with camphor dissolved in spirits of turpentine. In this aperture a double suspension string may be secured by a wooden peg or by cement, finished even with the surface of the ball. As this is troublesome to do without a lathe, strips of leather may be pasted across the tops of the spheres. A portion of the center of each strip should be cut narrower than the rest, and a needle, bit of wire, or broom straw placed under and across this portion in pasting. Before the paste dries this must be withdrawn, leaving an opening for the string to go through. For paste, gum tragacanth, softened in water to the consistency of butter, must be used. It is spread over the leather, and the strip is put in place. At first it does not adhere to any extent, but as it dries it holds with extraordinary tenacity. Strong linen thread answers for suspending cords.

A simple support, 12 or 16 inches high, made of three pieces of wood is provided. Its construction is shown in the cut. On this the spheres are suspended by double threads, tied into loops. The tying must be such as to give the same length to all, and bring the balls into tangency in the same horizontal line. The object of the double suspension is to restrict the oscillations of all the balls to a single plane. Four or six marbles may be thus suspended.

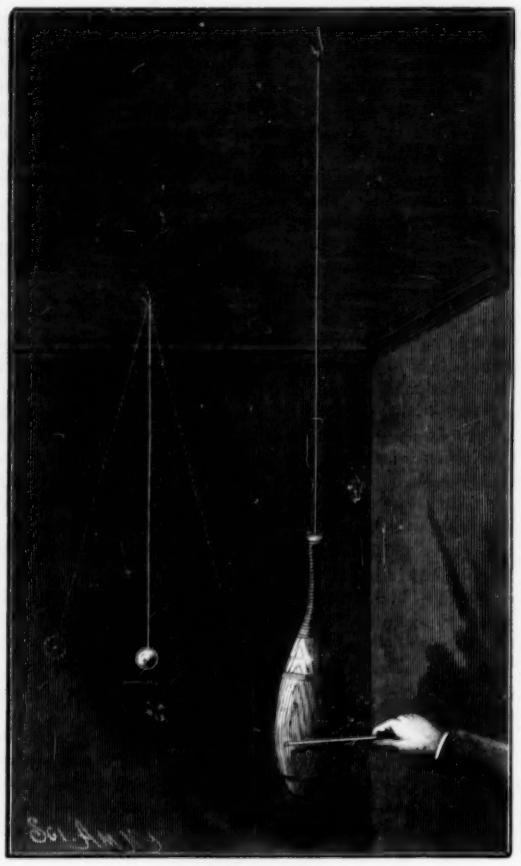
An end ball is swung aside, keeping it carefully in its plane and at the full stretch of its cord, and is released. It swings down and strikes its neighbor, comes to rest, and simultaneously the most distant one starts off, and, performing a half oscillation, returns, comes to rest, and the first one starts off in like manner. In this way the motion is kept up for some time, gradually degenerating into a swinging



COLLISION BALLS.

motion of all together. It can be done with two balls or more, and has a very good effect. With three balls on the frame, two may be swung aside and released. In this case, the center ball keeps swinging to and fro, accompanied first by one and then by the other of the end ones. A shock from a hard body is transmitted instantaneously through almost any number. A light blow from the back of a penknife causes the furthest ball to start away as if by magic. The lighter sphere falling produces a slighter effect in proportion to its weight. With two spheres, upward of a hundred impacts may occur before they come to rest.

It is essential that they shall be hung so as to be in full contact, yet not so as to press against each



HARMONIC IMPACT.

other. If this condition is departed from, their movements will be unsatisfactory.

The *rationale* of their action is that the impact slightly flattens each sphere, which, expanding, communicates the shock to its neighbor. The most impressive feature is the rapidity of the transmission of the shock and the evident conservation of energy that obtains. In some motions, it seems as if the balls were animated with life.

The production of motion from slight impacts repeated at proper intervals is shown in a simple experiment illustrated in the other cut. A heavy object, such as an Indian club, is hung at the end of a line about six or eight feet long. At a distance from it a weight is suspended, and the length of its string so adjusted that it swings in as perfect synchronism as possible with the club or heavier weight. The latter is now brought to rest, and the other weight is made to swing. Using it as a timer, light blows are given to the club, as near its central zone as may be. They are timed so as to strike it as the swinging weight reaches one end or the other of its course. At first no effect is visible, but on keeping up the impacts, striking with exactness, once for each double swing of the timing pendulum, the heavy club gradually begins to oscillate, and by perseverance may be made to swing over a large arc. The force of so many slight blows is stored up in its motion. Instead of striking it, the force of the breath may be used, a series of accurately timed puffs being discharged against it. A very heavy body may thus be set in motion.

This was the principle of some constructions of the battering ram. Very remarkable instances of the effect of such synchronous impacts have occurred in factories. The motion of an engine running at a particular rate has sometimes caused a series of shocks corresponding so closely with the periods of oscillation of the building as to threaten its destruction. In some cases a bucket of water could not stand on the floor without losing its contents. On running the engine faster or slower, these troubles have disappeared. In carrying a vessel full of water, care must be taken not to let the swing of the body correspond with the period of oscillation of the water contained. If it does, it will infallibly splash over the sides.

Impact of non-elastic bodies is attended with great loss of energy and corresponding development of heat. Recurring to the first experiment, balls of lead or little bags of sand may be substituted for the glass balls. In this case, after impact all the objects will swing together with greatly reduced energy. The impact develops heat, which is of course so slight as to be unappreciable. In the second experiment where impact is used, the body striking and the one struck should both be as elastic as possible. If the impact in either experiment be produced by the tip of the finger, no push being given, its action will amount to very little. The slightest blow with a hard object will have an effect much greater than a comparatively hard blow (not push) with the finger.

POLARIZED LIGHT.—NORREMBERG DOUBLER AND THE STUDY OF THIN FILMS.

BY GEO. M. HOPKINS.

III.

One of the simplest and best instruments for a certain class of investigations in polarized light is the Norremberg doubler, named after its inventor, and shown in a very simple form in the annexed engraving.

To one edge of a wooden base, 6 inches square and three-fourths of an inch thick, is secured a vertical standard, 1 inch square and about 15 inches high, and to the top of the standard is attached an arm extending over the center of the base, and apertured to receive the short tube containing the analyzing prism or bundle of glass plates. The tube may be made of paper, hard wood, or metal, and it should be fitted with a shoulder, so that it will turn readily in the aperture of the arm. To the standard below the arm is fitted a stage formed of a thin piece of wood centrally apertured and blackened.

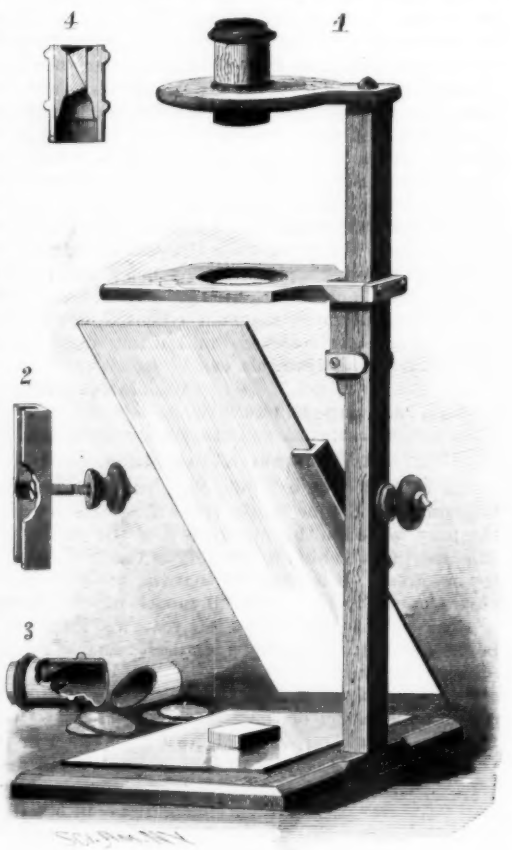
The stage is notched to receive the standard, and is attached to a short vertical bar 1 inch wide. A clip of wood extending across the back of the bar, and two small clips secured to the sides of the short vertical bar, bear with sufficient friction on the standard to hold the stage in any desired position.

About 6 inches above the base a grooved wooden strip is pivoted to the stardard, by means of a common wooden screw, passing loosely through the grooved strip and tightly through the standard. A wooden knob is turned on the end of the screw, and serves as a nut to bind the grooved strip in any desired position. The strip, screw, and knob are shown in detail in Fig. 2.

Into the groove of the strip is wedged or cemented a plate of glass, 4 by 9 inches. A fine piece of ordinary window glass will answer, but plate glass is preferable.

Upon the base is laid a square of ordinary looking-glass, or, better, a piece of plate mirror.

The tube shown in detail partly in section in Fig. 3 is provided with an inner tube of pasteboard or wood, divided obliquely at an angle of 35° 25′ with the axis of the tube, and upon the oblique end of one half of the tube are placed twelve or fifteen well cleaned elliptical microscope cover glasses, which are held in place by the other half of the divided tube. This bundle of glass plates, if of good quality and well cleaned, forms a very good analyzer; but instead of this, if it can



SIMPLE NORREMBERG DOUBLER.

be afforded, a small Nicol prism should be secured and mounted in a centrally apertured cork, the latter being inserted in the analyzer tube, as shown in Fig. 4.

The object to be examined may be laid either on the stage or on the mirror below. If viewed on the stage, the usual effects will be observed; but if laid on the mirror, it is traversed twice by the light, once by the incident beam and once by the reflected beam. This

is particularly noticeable in thin films of mica and selenite, and it serves as an excellent means for selecting eighth and quarter wave plates, which are useful in the study of circular and elliptical polarization.

As stated in a former article, the writer intends to deal sparingly with the theoretical part of the subject, that having been treated extensively in many physical works and in books especially devoted to light and optics. "Ganot's Physics" is prominent among works of its class, and "Light," by Lewis Wright, and "Polarization of Light," by William Spottiswoode, are excellent books bearing directly on the subject. The writer knows of no better means of securing a good knowledge of polarized light than by reading these three books.*

Returning to the matter of the thin films: It is quite difficult to produce a perfectly uniform thin film of selenite, owing to the brittleness of the material. For this reason, mica is generally used, as it possesses considerable flexibility and toughness. The common method of cleaving off thin films of mica is to split off a moderately thin plate and then separate the laminæ at one of the corners by bending it between the thumb and fingers. A medium sized sewing needle secured point outward in a slender handle is probably the best instrument for teasing the laminæ apart; but after the separation begins, the thin end of the ivory handle of an ink eraser seems to serve the purpose exceedingly well.

A score or so of plates are split, and examined one by one in the Norremberg doubler, by laying them on the mirror and turning them in their own planes, while the polarizer and analyzer are parallel. Should the plates exhibit any unevenness under the test, they should be at once rejected. Such as exhibit an even tint should be preserved carefully, and examined further to determine which, if any, possess the required qualities. Not every piece of mica will split evenly, therefore it may be necessary to make several trials before success is attained.

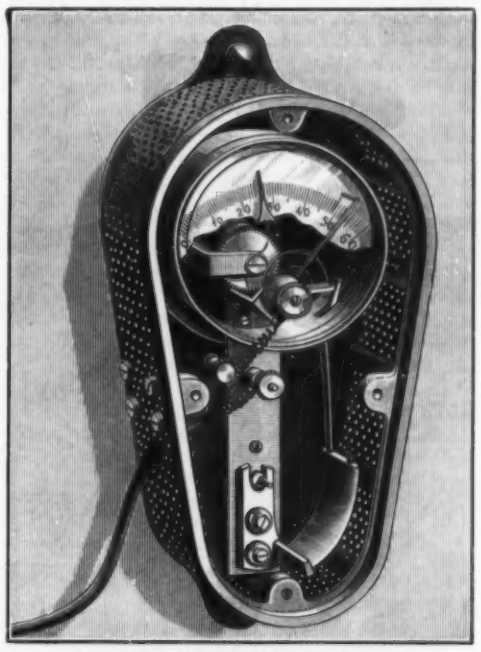
Should the film, when placed on the stage, exhibit a dull plum color, slightly inclined toward red, when the polarizer and analyzer are parallel, it produces a difference of phase of half a wave length, and is called a half wave film. As a matter of course, if two films of like thickness, superposed and arranged with their axes in the same direction, produce the same color under the same circumstances, they are one-fourth wave films; and if a pair of films exhibit the same color when similarly arranged on the mirror of the doubler, they may be regarded as eighth wave films, as the polarized beam passes twice through the film to produce the same tint. These films should be carefully mounted between glass plates, either dry or in benzole balsam, the latter being preferable.

The practical application of the eighth and quarter wave films will be treated in a future paper. Beautiful and instructive designs made from thin films are described and illustrated in Wright's "Light," to which reference has been made.

* These books may be had at this office at publishers' prices.—ED.

WINDING ENGINE FOR AUSTRALIA.

The winding engine illustrated by the accompanying engraving, which we take from *The Engineer*, was



GERBOZ'S ALARM THERMOMETER.

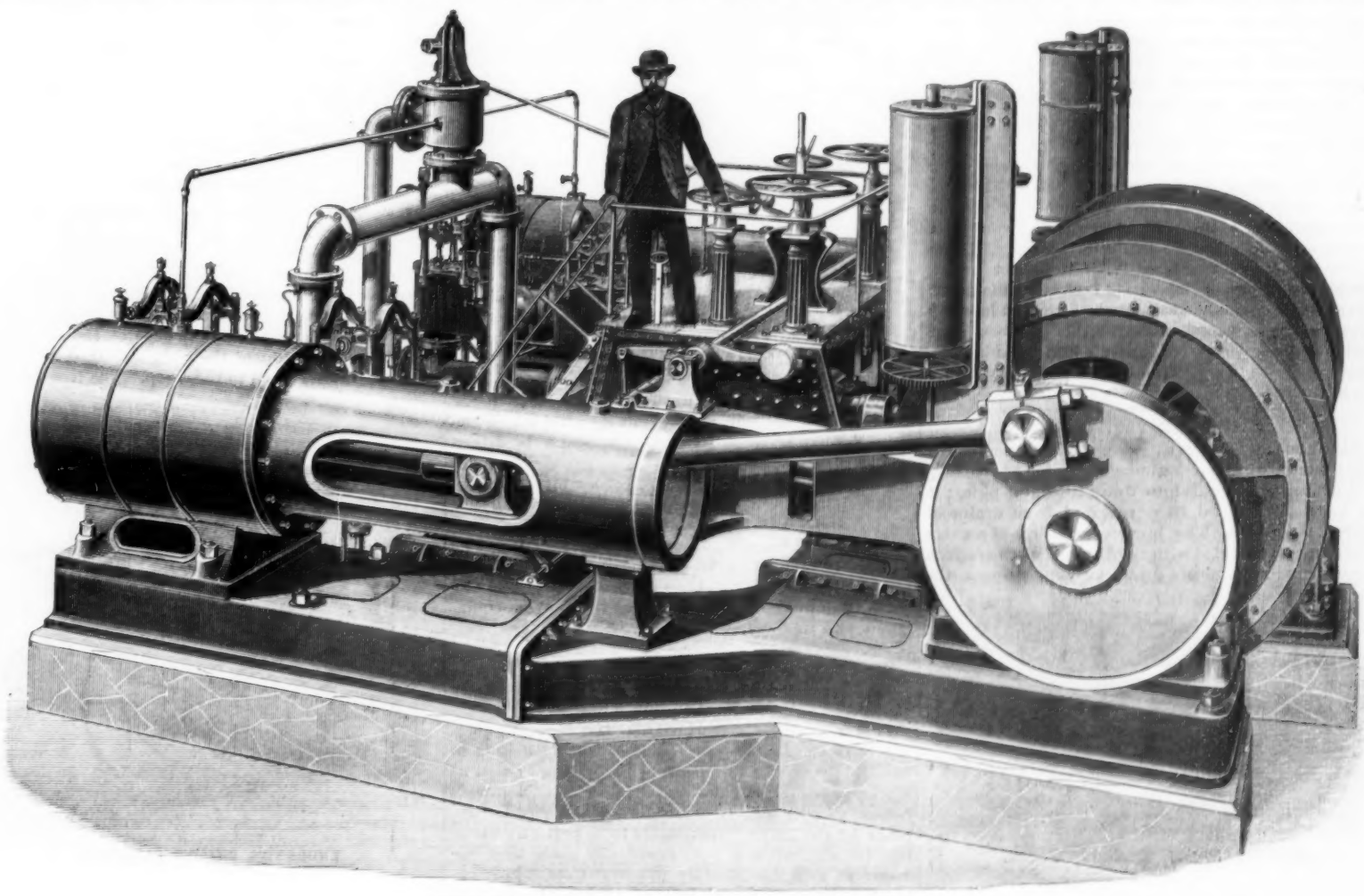
made by Messrs. Tangye, of Birmingham, England, under the instructions of Mr. J. D. Baldry, M.I.C.E., for use in the extensive coal mines of the Australian Agricultural Company, of New South Wales. This design, which, in some respects, is a departure from general practice, has proved satisfactory in all respects, and has met with special approval from mining engineers in the colonies. The cylinders are 32 inches in diameter by 48 inches stroke, and are steam-jacketed, with separate steam pipes and valves for supplying the jackets direct from the main supply pipe. The steam and exhaust valves are of the Cornish type, double beat equilibrium, two separate nozzle boxes being fitted to each cylinder containing the valves.

The crank shaft is of Siemens-Martin steel, 10½ inches in diameter at the journals. The bearings are in three parts, of gun metal, with wedges and screws for adjustment, and arranged so that they can be removed without taking out the shaft.

The hauling drums are 6 feet in diameter by 3 feet wide, are loose on the shaft, and are driven by steel clutches. Each drum is provided with a brake, fitted with oak blocks. Between the engines is a raised platform, on which are placed the clutches, brakes, wheels, reversing lever, steam valve handle, and rods for working the condenser steam cocks. The engines, platform, etc., are mounted on a strong cast-iron bed plate.

As these engines are to haul about 2,000 yards, they are fitted with an arrangement for accurately indicating the position of the tubs at any point in their journey. This consists of a vertical drum rotated by gearing, and having traced upon it a spiral line, along which the positions of the various stations are marked. A pointer moving on a screwed shaft, driven by worm gearing from the main drum, traverses the spiral, and so indicates the position of the truck.

The speed of hauling is 9 miles per hour, and about eighty skips, of 10 cwt. each, make up a load.



COLLIERY WINDING ENGINE FOR AUSTRALIA.

THERMOMETER WITH ELECTRIC ALARM.

The thermometer figured herewith is designed for giving indications as to the temperature of silos, grain depositories, piles of coal, or certain fabrics that are apt to burst into flame spontaneously and set fire to factories or ships.

The thermometer used is a metal one, of the Bourdon type, inclosed in a strong cast iron box, provided with a cover of the same nature. This latter is omitted in the figure, so that the internal arrangement may be seen. This box is everywhere perforated, so that the thermometer may be in contact with the surrounding air. The apertures, however, are small enough to prevent the entrance of particles of coal or fragments of seeds, etc.

The apparatus, when placed in a coal bunker or a silo, is connected with the exterior by means of conductors that traverse the surrounding substance, and that serve to indicate, at every moment, that the temperature has or has not reached a dangerous height. As soon as the needle of the thermometer strikes an index, placed at the degree of temperature that it is important to know (50°, for example, showing that there is danger of fire), a bell rings.

We shall now give a few details of construction: As the rotary axis of the needle and that of the index are on the same line, contact between these two pieces takes place at the same point, whatever be the respective angular position of these two parts. Instead of being a simple rod, making one piece with the maneuvering button, the index is composed of a barrel that forms one piece with the button, and upon which is mounted (1) the index needle properly so called, (2) a spring for holding the index in a constant position with respect to the barrel, and (3) a toothed pinion. This latter gears with a cog wheel upon the same axis with the polarized armature of an electro-

magnet. This armature moves in a plane at right angles with the axis of the bobbins of the electro, and as near as possible to the extremity of the core.

The electric communications are established and the two proposed controls are made as follows: The cable consists of three conductors. One of these runs from the negative pole of the battery to the thermometer needle and one of the wires of the electro. Another runs from the index to the alarm bell, and from thence to the positive pole of the pile. The third runs from the positive pole of the pile to a galvanometer, then to a button or interrupter, and from thence to the second wire of the electro.

When a contact has been established by the button, the current, on traversing the galvanometer and causing it to deflect, indicates that the two wires and the electro magnet are in proper order. When the current traverses the electro, it polarizes the cores, and causes the armature, and consequently the movable index, to revolve around the barrel; and under the action of the armature, the index thus tends to move from the maximum point toward the needle, and, with it, to establish a contact that rings the alarm bell.

When the current is broken by the button or interrupter, the armature, as the current no longer traverses the electro, returns along with the maximum needle to its position of rest, under the action of the spring mounted upon the axis of the index.

Were the maximum index made to bear against a metallic rack, forming an electric interrupter in a special circuit comprising an electric counter, we might count the number of contacts between the maximum point and the needle, and thereby ascertain the latter's position.

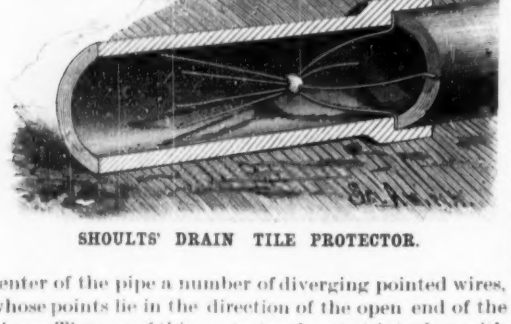
It will be seen from what precedes that the apparatus may be submitted to a permanent control that permits of making sure that it is ready to operate regularly. Such control is of prime importance, since this thermometer is designed to be used in inaccessible places (coal bunkes, silos, and so forth), the dampness of which might interfere with the contacts being kept in a proper condition. Besides, the motions of a ship on the sea might cause a breakage of the cable, nothwithstanding that it is covered with steel. These two things cannot occur without attracting attention. —*La Nature.*

Sea Water as a Preservative.

The Vigo Bay Treasure Company, of London, lately received a curious collection of articles taken from the treasure galleons sunk in the harbor of Vigo, Spain, in 1702. There are specimens of logwood and mahogany that, in spite of their 184 years' submersion, are in a perfect state of preservation. Dyers who have experimented with the logwood state that it is even better for dyeing purposes than the wood now imported. The mahogany, too, is very fine and solid. One log has arrived 12 feet long and 22 by 32 inches square, which is now being sawed up to be used in the manufacture of furniture and walking sticks for mementoes. The chief curiosity, however, is an ancient pulley block, 4½ feet high by 3 feet broad, with four solid copper sheaves, 18 inches in diameter. It is of solid oak, and was probably used in hoisting heavy articles of merchandise or the anchors. The wood is perfectly preserved, but an iron band is completely corroded away, while the copper wheels are only slightly oxidized.

DRAIN TILE PROTECTOR.

This simple and efficient device, the invention of Mr. A. L. Shoults, of Bloomingburg, O., is for preventing the entrance of animals into drain tiles and pipes; it can be readily applied to or removed from drains of different diameters. The protector consists of a series of spring arms provided with right angled arms adapted to enter into the joints of a drain, and supporting in the



SHOULTS' DRAIN TILE PROTECTOR.

center of the pipe a number of diverging pointed wires, whose points lie in the direction of the open end of the pipe. The use of this protector does not interfere with the free discharge from the drain, while it effectually prevents small animals from entering by presenting a series of sharp points protecting the entire area of the drain. The device is applied by compressing the arms sufficiently to permit the fingers to be introduced into the mouth of the tile, when it is pushed along until the fingers enter the joint. The points of the wires are centrally held in the tile, and cannot be easily displaced.

RAILWAY CROSS TIES.

To the Editor of the Scientific American:

I noticed in your paper of January 16 a letter from Geo. H. Ford relative to railroad cross ties, and I would say that, from extensive observation and special examination, I fully agree with him that there are more ties destroyed by mutilation of the timber by the spikes than there is by natural decay. This is es-

SECTION OF WHITE CEDAR TIE WITH SPIKE DRIVEN IN.

pecially the case with soft wood ties, such as pine, chestnut, white cedar, cypress, and redwood. And the whole difficulty arises from driving a large, dull edged, wedge pointed spike into the tie without first making a hole for it, or else having a special point on the spike, which practically does the same thing.

It is imperatively necessary to good work that the fiber of the timber should be severed before the body of the spike enters it. The whole damage is caused by the point, and is caused in the following manner: The point being dull and nearly always imperfect, as at present manufactured, does not readily cut the fiber of the timber, and it doubles around the point, and is carried down and packed until it is sufficiently dense and hard for the dull edge to cut it; after which the same process is repeated until the spike is driven home.

I send you herewith a section of a white cedar tie with a spike driven in and split open, illustrating this theory, and I think you will agree with me that it is mechanical barbarism to continue such practice. The mode of fastening the rail to the tie and the link and pin coupler are the two twin relics of a past age, but I think from present indications that their days are numbered, and that something better will soon take their place. WILLIAM GOLDIE.

West Bay City, Mich.

"Can Imagination Kill?"

This is, perhaps, hardly the correct form of question that the *British and Colonial Druggist* puts to itself in discussing the death of the young woman at Hackney under circumstances in which Keating's insect powder largely figured. As the powder appears by Dr. Tidy's experiments to be perfectly harmless, the suggestion is not unnaturally made that the deceased, who was possibly of a hysterical, highly imaginative turn of mind, took the powder in the full belief that by its means her death might be accomplished. The writer of the article in our contemporary, we think wrongly, brings forward two remarkable instances of what may be regarded as practical jokes with melancholy terminations. In the case of the convict delivered up to the scientist for the purpose of a psychological experiment (the man was strapped to a table and blindfolded, ostensibly to be bled to death; a siphon containing water was placed near his head, and the fluid was allowed to trickle audibly into a vessel below it, at the same time that a trifling scratch with a needle was inflicted on the culprit's neck; it is said that death occurred at the end of six minutes), fear must have played no inconsiderable share in the fatal result, and we do not know whether all the vital organs were in a sound condition, though they were presumably so. The old story of the case of a college porter is also one in point. The students entrapped him into a room at night, a mock inquiry was held, and the punishment of death by decapitation decreed for his want of consideration to the students. It is small wonder that, under the dominion of fear and belief in the earnestness of his tormentors, the sight of an ax and block, with subsequent blindfolding and necessary genuflexion, a smart rap with a wet towel on the back of his neck should have been followed by the picking up of a corpse.—*Lancet.*

The Sleeping Disease.

There is a singular and invariably fatal malady, called lethargus, peculiar to the negroes of certain districts on the western coast of Africa, which has never, we believe, been noticed in the medical journals of this country except in the *Massachusetts Medical Journal*, from which we copy. But this is not surprising, when we consider that a knowledge of it is practically unimportant to the profession outside of the districts where it occurs. As a curiosity, however, in the form of a disease, it cannot fail, we think, to interest the medical faculty of our country, and we therefore present, in brief, the main facts concerning this singular disorder. As the name implies, the principal, and in fact the only, symptom that presents itself is lethargy; and one case is essentially a stereotype of all.

The patient, usually a male adult, is seized, without any premonitory symptoms, with a sensation of drowsiness, which continues rapidly to increase, in spite of all efforts to throw it off, until he sinks into a profound and seemingly natural sleep. This continues for about twenty-one days, when death takes place. Throughout the course of the disease, the patient preserves a quiet and peaceful countenance, may be easily aroused for a short time, will take nourishment, and generally answer a few questions in a perfectly rational manner. The pulse, respiration, and temperature remain normal throughout, the pupil is neither dilated nor contracted to any noticeable extent, and the urine and fæces are voided with comparative regularity. With the exception of the abnormal tendency to sleep, nothing exists to denote disease.

Many careful post-mortem examinations have been made by competent men, but nothing of an abnormal character has been found, while every remedy that could possibly be of any avail has been used without any apparent beneficial effect. They sleep on, and quietly glide into eternity in spite of professional skill.

CHILD'S CARRIAGE.

To the center of the axle of this carriage is attached a vertically arranged hoop, to which are rigidly secured two side standards, shaped as clearly shown in the engraving. The upper end of each standard is notched to receive the knife-like edge of brackets fixed to either side of the carriage body, which is thus supported by and is free to swing upon the ends of the standards. The range of motion of the body is defined by rubber or spring buffers fixed to the hoop. The front stop or

ENGLAND'S CHILD'S CARRIAGE.

wheel is carried by a bracket attached to the axle. To the rear of the hoop is secured a forked arm, having a handle. The sunshade may be moved to and secured at any desired position on the hoop. In moving the carriage, the forward stop or imitation wheel is slightly raised from the ground by depressing the handle, when the carriage can be moved as desired. When the fixed wheel rests upon the ground, it acts as a brake, preventing the carriage from moving forward by its own gravity when placed upon an incline.

This invention has been patented by Mr. William England, P. O. Box 374, Galveston, Texas.

A New Mountain Observatory.

German papers inform us of the erection of an observatory on the Sonnblick, one of the summits of the massif of the Tyrolese Alps, the highest elevations of which are the Grossglockner, the Wiesbachhorn, and the Hohe Narr. Extensive glaciers and eternal snow, from which those giants rise, cover those almost inaccessible heights and their neighbors. The Sonnblick (Sun Glance) is a mountain nearly 10,000 feet high, the summit of which is less difficult of access, and where a house is now being erected which is to serve for meteorological observation. It will consequently be an observatory at the highest elevation in Europe—higher than that on Mount Etna, the Pic du Midi in the Pyrenees, and on the Sentis, canton of Appenzell. The first to draw the attention of meteorologists to this mountain as a suitable spot for an observatory was the owner of the Rauriser Goldberg, Mr. Rojacher. His private residence and mines are situated on the slopes of the Sonnblick, at an elevation of over 5,000 feet, and from these a wire ropeway, used for the purposes of the mines, but also practicable for passengers, leads up to a height of nearly 8,000 feet. Here a house has been erected for about twenty miners, who reside there also during winter. Thence the summit of the mountain is reached by an easy ascent over a glacier, in three hours. In descending, this portion may be traversed in low sledges in fifteen minutes.

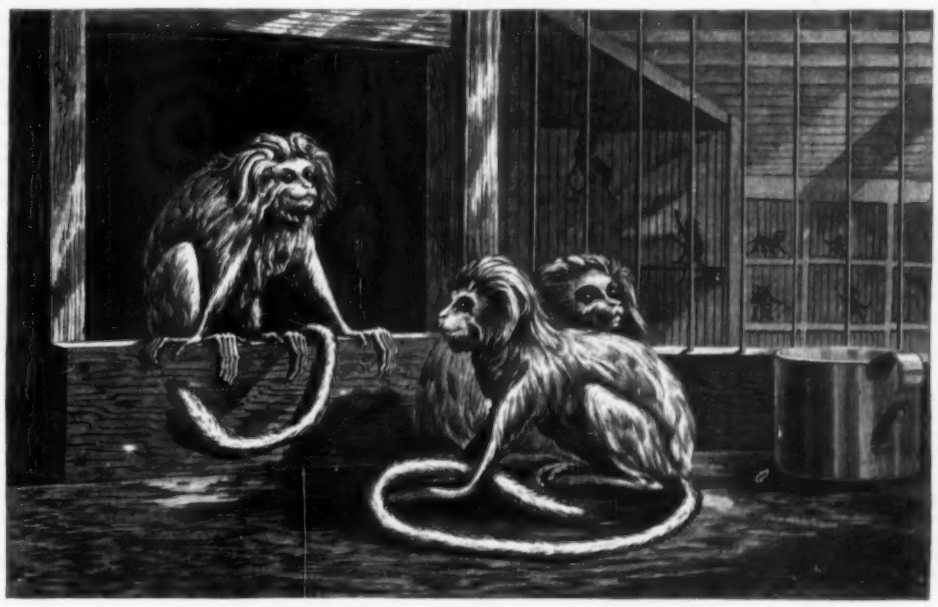
The observatory now being erected on the summit, and which looks like a black spot when viewed from the Rauris valley, and from which the Sonnblick rises like a precipitous wall, 3,000 feet high, consists of a blockhouse, flanked by a massive stone tower forty feet high. To guard against the frightful storms raging round the summit, the walls of the tower are made of enormous thickness, while the blockhouse itself is anchored to the rock by stout wire ropes. Wood has been selected for the construction of the house, because it keeps out the cold better, which is most intense in that exposed spot in midwinter. The house contains two living rooms —one for the resident observer, and another for those scientific men who may ascend in favorable weather with a view of carrying on experiments. The walls of the house are paneled inside, and neatly covered outside by wood shingles. The tower will be fitted with all the instruments used in meteorological observations. As there is great danger to the building from the terrific thunder storms which burst round the summit, the observatory is protected not only by three lightning conductors, but also by a lightning-proof fencing. The solitary resident observer who has chosen to exile himself from the outer world is one of the twenty miners permanently residing in the miners' house, 8,000 feet above the sea level, who is now undergoing a course of instruction in meteorology. But he will not be cut off entirely from intercourse with his kindred, for he will be able to keep up communication by telephone with the miners' house 2,000 feet below him, whence another telephone wire, 15 miles long, leads to Rauris. From there his daily record of observations will be wired to Vienna, thence to be flashed to the scientific world generally.

Comicalities in Plants.

There is Jack-in-the-pulpit, the flower of the plant known as Indian turnip (*Arisæma triphyllum*). Who could ever look at one of these singular blossoms, says a writer in the *Western Review of Science*, without that same stirring of the risible faculties which one experiences in perusing a parody or caricature, or witnessing a pantomime? The very sight of one is provocative of mirth. How many times in my school days did I challenge the teacher's frown by involuntary giggles at the whimsical look of the imprisoned Jack! Monk's hood, of the genus Aconitum, has quaint, comical flowers, suggestive of an old lady's head in a night cap. The well-known fly-trap, *Dionœa muscipula*, strikes the mind with all the effect of a joke. The leaves of this plant are fringed with stiff bristles, and fold together when certain hairs on heir upper surface are touched, thus seizing insects that light on them. Seeing the leaf stand temptingly open, a poor fly pops in for shelter or food. No sooner has it touched its feet than some sensitive fibers are affected, and the cilia at the top closes in upon the intruder, imprisoning him as effectually as if a boy had taken him and closed him in a box. The pitcher-plant, or monkey-cap of the East, although not particularly ludicrous, has a whimsical arrangement which borders closely upon the human economy. To the footstalk of each leaf of this plant, near the base, is attached a kind of bag, shaped like a pitcher, of the same consistence and color as the leaf in the earlier state of its growth, but changing with age to a reddish purple. It is girt around with an oblique band or hoop, and covered with a lid neatly fitted, and movable on a kind of hinge or strong fiber, which, passing over the handle, connects the vessel with the leaf. By the shrinking or contracting of this fiber, the lid is drawn open whenever the weather is showery or damp. When sufficient moisture has fallen, and the pitcher saturated, the cover falls down so firmly that evaporation cannot ensue. The water is thus gradually absorbed through the handle in the footstalk of the leaf, giving sustenance and vigor to the plant. As soon as the pitchers are exhausted, the lids again open to admit whatever moisture may fall; and when the plant has produced its seed, and the dry season fairly sets in, it withers, with all the covers of the pitchers standing open. The flower of the *bee orchis* is like a piece of honeycomb, and the bees delight in it. Then there is the snap dragon, the corolla of which is cleft and turned back so as to look like a rabbit's mouth, especially if pinched on the sides, when the animal appears as if nibbling. The flower of the cock's comb, and the seed-pod of the *Mostynia proboscidea* bear curious resemblance to the objects which have suggested their names. Some kinds of the *Mendicago* have also curious seed-pods, some being like beehives, some like caterpillars, and some like hedgehogs —the last being itself an essentially ludicrous object.

RARE SPECIMENS OF MARMOSETS.

Mr. Thompson, of Sixty-fifth Street and First Avenue, New York, a well known importer of rare and curious wild animals, etc., has recently brought here some of the beautiful little animals shown in our illustration. They are a species of South American monkey, and, though not as intelligent as other monkeys, are easily trained, and make an interesting and affectionate pet. Its disposition is gentle, but its constitution is so delicate that it can only with difficulty be kept in temperate climates. The body is six to seven inches long, the hair of a golden yellow, soft, fine, and silky, and they live principally on insects, which they dig out of the earth or from under the bark of trees with their long fingers, although in captivity they will eat almost any vegetable or animal food These marmosets are the only ones of the kind ever brought to this country; they come from Brazil, and are only found in a very limited locality near Rio Janeiro.



THE SILKY MARMOSET. [HAPALE ROSALIA.]

Heterogeneous Grafting.

Strasburger, in the *Berichte der Deutschen Bot. Gesellschaft*, vol. 3, records some curious results of his experiments in intergrafting various herbaceous *Solanaceæ*. Thus, he successfully grafted species of stramonium and common tobacco plant, henbane, Atropa belladonna, and petunia upon the common potato plant. Grafts of *Datura stramonium* and *Nicotiana tabacum* took remarkably well, the plants growing freely and coming into flower. Tschudy, however, long ago, had grafted *Lycopersicum* upon a potato stock, and so had gathered potatoes from the bottom and tomatoes from the tops of the same plant; but this is not so extraordinary, the two plants being so essentially congeneric.

The most remarkable result of Strasburger's trials was that, when *Datura stramonium* was grafted upon a potato plant, the potatoes borne by the latter, to all appearance normal, were found to be impregnated with atropine. He does not say whether these grafted into *Nicotiana tabacum* had their tubers infected with nicotine.—*American Journal of Science.*

New Mode of Reducing Metals.

A new and very promising mode of directly separating metals from their ores, by James J. Shedlock, of London, is now being tried on a practical scale in that city. Mr. Shedlock's method is carried into effect by passing the ore in a finely divided state through a bath of molten metal maintained at the temperature necessary to insure its combination with any free metal contained in the ore. But as most ores contain metals associated or in combination with the metalloids, it is necessary to decompose such compounds in order that the metals may be freed and in such a condition as to readily combine with the metallic bath. This is accomplished by forcing streams of reducing gases through the bath of molten metal simultaneously with the pulverized ore, which is conveyed into the bath at one end by feeding apparatus, the action of which is so regulated as to work in concert with the supply of reducing gases. For the production of these gases, steam is passed through superheaters, the outlets of which communicate with gas producers, which produce carbonic oxide and hydrogen gases, which are conveyed from the producers by tubes into the bath of molten metal at the point of entry of the powdered ore. In consequence of the affinity possessed by these gases for the metalloids, and also by reason of their high temperatures, the metallic compounds are decomposed and the volatile constituents of the ore are vaporized, which, with the earthy or non-reducible portions, by reason of their lesser specific gravity, rise to the surface of the bath of molten metal. The gases and vapors are conveyed through flues into chambers, where those that are condensable are thrown down and collected, the permanent gases escaping into the chimney shaft, and the earthy matters being removed from the end of the bath opposite the feeding end by skimming. The metals as they accumulate in the bath overflow into receivers through spouts, the inner mouths of which are so much below the surface of the metal as to prevent any dross from passing over. The metals as they collect are run into ingots or bars.

In treating some ores, more particularly those containing the noble associated with the baser metals, it may be found desirable to refine those metals without removal from the bath. For this purpose atmospheric air raised to the required temperature is forced through the molten metals in the bath, its passage being retarded by an inclined cover, thereby causing agitation of the mass and subjection of the metals and metalloids to the oxidizing action of the heated air. The oxides and other combinations thus formed with the vapors and gases rise to the surface, and are conveyed by the flues to the condensing chambers, the refined metal being withdrawn from the bath and run into ingots. The superheaters, gas producers, and air-heating chambers are inclosed in a firebrick structure, into which the heated products of combustion from the furnace enter and circulate, thus raising the temperature of the apparatus and its contents to the required degree. The furnace gases then pass into the flues surrounding the bath containing the molten metals, eventually escaping into the chimney shaft. According to Mr. Shedlock, there are no exceptions to the ores which may be manipulated by his invention, the most refractory as well as the most easily reduced being successfully treated by its means. The ores of iron, when subjected to the process for the extraction of that metal, are stated to be most readily reduced, and its direct conversion at one operation into the different carbides of iron, varying from the softest cast iron to the mildest steel, easily accomplished; at the same time, all deleterious impurities are said to be effectually removed. The ores of zinc are also readily treated by this process as a continuous operation, the ore being fed into the apparatus, and the metal as it is distilled over passing away through the flues into the chambers, where it is condensed and collected. Should the process be as successful on operation on the large scale as is anticipated, we may expect an increased supply of gold, as by its means the most refractory ores of gold may be treated. By the ordinary system of separating gold from its ores, it is acknowledged that not much more than 50 per cent of the gold present is recovered. The details of the invention, as well as those of the apparatus by which it is to be carried into practical effect, have been carefully thought out, and the reasonableness of the *modus operandi* gives every hope of its commercial success.

To destroy ants, sprinkle powdered borax around the infested places.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Edmund O. Sawyer, of Point Pleasant, W. Va. It is a simple device for adjusting a link held in one drawhead to properly enter an opposing drawhead of an equal or different height, by which the link may be adjusted from either side of the car, or, by means of proper connections, from the top of the car.

An auxiliary air accumulator has been patented by Mr. Michael P. Drummey, of Grand Junction, Col. It consists of an attachment to the steam chest of a locomotive, adapted to be connected with the air brake system, and calculated to quickly accumulate compressed air for use in case the supply employed to operate the brakes becomes exhausted from defective action of the compressing mechanism or other cause.

A smoke burning furnace for steam boilers has been patented by Mr. William T. McDonald, of New York city. In the flue by which the smoke and unconsumed gases would naturally escape is formed a dome-like expansion at one part, into which opens funnel-like mouths of a pipe leading to an aperture in front of the fire chamber; opposite this end of such pipe is a nozzle connecting with a kerosene reservoir, and another nozzle connecting with the steam space of the boiler, the discharge of steam through which forces the oil and unconsumed products of combustion drawn back from the flue together in the form of spray upon the fire; the pipe with funnel openings for withdrawing unconsumed products from the smoke flue is also further connected with a pipe extending around the end of the boiler and terminating in an outlet to the air in front of and under the fire grate.

AGRICULTURAL INVENTIONS.

A potato planter has been patented by Mr. Charles C. Maves, of East Davenport, Iowa. It has various novel features of construction and arrangement of parts, whereby potatoes may be planted either in hills or drills, and is so designed that the space between the hills may be varied, as also may the distance between the seed when the potatoes are planted in drills.

MISCELLANEOUS INVENTIONS.

A hoe and rake has been patented by Mr. Frank Middleton, of Richmond, Va. This invention provides for the attachment of the blade and parts to the handle by a screw fastening, whose parts are so protected that dirt has no access, and the lubricant is not likely to be washed out, whereby rusting is prevented and the parts will be easily adjustable.

An improved form of shirt with detachable bosom has been patented by Mr. Julius Schlesinger, of Chicago, Ill. The shirt has an open bosom space, around which extends re-enforcing strips having buttons, a transverse bracing strip extending across the space below the neck band, and permanently attached to the shirt.

A carriage gear has been patented by Mr. Edward Squires, of Beaverton, Oregon. This invention covers a single reach side spring gear, which brings the body of the carriage low down, and makes an easy up and down motion, free from side play and loose joints, being designed with regard to simplicity, cheapness, durability, and finish.

An improved lamp globe sign has been patented by Messrs. Harry L. and Willard L. Harris, of San Francisco, Cal. The lamp globe is made with an opening adapted to hold a framework and sign, in such position that the lettering or symbols will be clearly defined on a wall, sidewalk, fence, or other object, the light of the lamp making the shadowed representation.

A gas regulator forms the subject of a patent also issued to the above inventors. It is an improvement in that class of regulators in which elastic diaphragms are used, and consists in making the diaphragm of horse hide treated with neatsfoot oil and beeswax, whereby the hide is rendered soft and elastic, and so it will not be injuriously affected by the moisture caused by condensation of the vapors from the gas.

A building block has been patented by Messrs. Christian Popp and Ludwig Melchior, of Wilmington, Del. It is intended especially for inside work, and is made of ground cinders and ashes, dry slaked lime, boiled glue, beach sand, plaster of Paris, and Portland cement, mixed with water and subjected to heavy pressure, to make a water and fire tight partition.

A cuff fastener has been patented by Mr. Stephen V. Thomas, of West Branch, Mich. This invention covers a distinctive and peculiar construction of holder, bent out of a single piece of wire, to connect a cuff with ease to a shirt sleeve, either high up or low down, the fastener being designed to take the place of a cuff button.

A door check has been patented by Mr. George N. Clemson, of Middletown, N. Y. It consists of a bracket on the door near the bottom, carrying a swinging arm with convex pad adapted to engage the carpet or floor, whereby the weight of the door will act on the arm and pad to produce sufficient friction to hold the door in any desired position.

A chimney cowl has been patented by Mr. Neal Clifford, of St. Joseph, Mo. It consists in a frame adapted to the chimney top, and combined therewith a revolving cowl shield supported by the frame with its bearings entirely above the cowl shield, and exterior to the chimney or smoke pipe, to prevent down draught and increase up draught.

An abdominal and spinal brace has been patented by Mr. William B. Dewees, of Salina, Kan. It has a front pad made of leather and elastic webbing, and the back combination includes a leather and elastic shoulder brace with S-shaped steel springs, and other novel details, the whole being designed to support and strengthen weakened parts with perfect comfort and freedom.

A chenille pendant has been patented by Mr. Bernhard Dreyfus, of New York city. Within the pendant loop is placed a stiff or rigid frame of metal, hard rubber, celluloid, stiff paper, or other suitable material, and the usual methods of making are otherwise modified, so that the pendants cannot easily be bent out of shape by the pressure to which articles on which they are secured are frequently subjected.

A process of separating the tin from scrap or pieces of tin plate or tinned iron by means of hydrochloric acid has been patented by Mr. Wilhelm Hasenbach, of Mannheim, Germany. It consists in heating the cuttings or scraps and subjecting them while hot to the action of hydrochloric acid in the form of a dry gas or vapor, distilling off the protochloride of tin and avoiding the necessity of washing the scraps.

A thill coupling has been patented by Messrs. Clarence M. Slack and Frank Crawford, of New Brunswick, N. J. Its construction is such that the wear will come mostly upon conical countersinks in the coupling block, and conical projections upon inner sides of parallel arms upon the forward arm of the bow, and this wear can be readily taken up and any rattling of the couplings prevented.

An animal trap has been patented by Mr. Sylvester Snell, of Watertown, N. Y. It is a box with a hinged bottom, the front end of which is heavier than the rear end and has an upwardly extending pin, with a swinging door attached to the front end of the box and operated by the pin in the hinged bottom, with other novel features, making a trap adapted to take animals alive.

A heating stove or furnace has been patented by Mr. John Adams, of Findlay, O. It is designed more especially as an improved construction for a gas or oil stove, in which air and gas are mixed within a perforated tube, around which is formed the blaze, and there is a novel arrangement of chambers and flues whereby the products of combustion are brought into contact with a large surface of metal.

A circular sawing machine has been patented by Mr. Everell S. Collins, of Meadville, Pa. This invention consists of a circular saw mounted on an arbor supported by a counterbalance, with pivoted levers for swinging the saw upward to a cutting position on the table, the device being adapted to promote convenience for use in a limited space, as the saw can be placed below the level of the table when not in use.

A drinking straw or tube holder has been patented by Mr. William E. Coleman, of Schooley's Mountain, N. J. It is in the form of a clamp, made of a single piece of spring sheet metal, suitably cut and bent to make lower clips, to fit over and hold on to the rim of a glass, while the upper part is bent to form tubular sockets adapted to hold the drinking straws or tubes.

A reaming tool for use in sinking bored well casings has been patented by Mr. William A. Lloyd, of Macksburg, O. It is a tool which has a compressible cutting head to go down through the casing, but which will expand below that to do the work of enlarging the bore to the full diameter of the casing, so that bores may be thus enlarged and the casing sunk as the boring proceeds.

A new form of belting has been patented by Mr. John D. Channell, of Nevada City, Cal. It is made with flexible side flanges, preferably of rubber, formed of hollow tubes, permanently attached to one face of the band near its edge, making a belt especially adapted for use in ore concentrators, etc., and for conveying water, pulp, and similar material without the use of guides or buckets.

A hose reel has been patented by Mr. Charles H. Weygant, of Newburg, N. Y. It is a spirally grooved reel cylinder, with a traveling frame through which hose may be passed, the hose being wound from its upper end downward by revolving the cylinder, and so held that all the water, when the supply is shut off, will flow out of the discharge end without its being necessary to open any wasteway.

A wheel and axle has been patented by Mr. Granville W. Pittman, of Keokuk, Iowa. On the inner side of a car wheel is a central circular cavity adapted to receive a disk on the end of the axle, the cavity carrying a rubber cushion, and a cushion collar being held in the neck, the device being intended to give increased leverage power and reduce friction, and also adapted for the hubs of carriage wheels.

A carpet rag attachment for sewing machines has been patented by Mr. Charles W. Chamberlin, of Lanark, Ill. This invention consists principally of a number of narrow holders, clamps, or springs connected together in line with each other and adapted to receive and hold the ends of the rags, so they may be passed with the device through a sewing machine and stitched.

A clothes drier has been patented by Mr. Ide V. Cooley, of Berlamont, Mich. Bent wire hooks are fitted to slide easily on a galvanized wire line stretched from the side of the window to a post or adjacent building, the hooks holding clothes drying bars, on which the clothes are fastened by the usual pins, the apparatus being arranged in such way that a large number of clothes can be hung in a very small space.

A wooden scoop has been patented by Mr. Nathaniel E. Nichols, of Mount Tabor, Vt. The heel of the scoop is formed in one piece of the required shape and thickness, to stand at the proper angle to the blade, and the blade tapered so that when bent to conform to the lower curved and beveled side of the heel the deep flaring part and front flat edge will be formed, the handle being secured in any convenient manner.

A tool handle has been patented by Mr. Louis Steinberger, of New York city. It is intended more especially for hammers, axes, and similar implements, the handle having a notched end, a tightening screw to enter the handle centrally in the notch, and a bar to rest crosswise upon the hammer to draw it down upon the handle, whereby the handle may be firmly screwed and subsequently tightened when required, or detached and applied to another implement.

An apparatus for manufacturing aerated beverages has been patented by Mr. Oscar Brunler, of New York city. This invention provides an apparatus for supplying liquid carbonic acid to the liquids to be aerated in the mixer, or fountain, through a tubular coil within the fountain, whereby the liquefied gas, by its expansion, has a cooling effect upon the contents of the fountain.

A machine for washing coal or other minerals has been patented by Mr. Robert Robinson, of Howlish Hall, near Bishop-Auckland, Durham Co., Eng. The separation of stone, dirt, etc., from the material to be washed is made by difference of specific gravities, the material being placed in water in a hopper-like vessel, in which an upward flow of water is maintained, with means for discharging impurities without interrupting the washing.

A calculator has been patented by Mr. Jules V. Charpantier, of New Orleans, La. The apparatus comprises a box or support, an indicator, an interest table, a maturity table, and a period table, in connection with various working devices to facilitate the determination of amounts of interest, number of days of interest and discount, and date of maturity of commercial paper, this invention being an improvement on a former patented invention of the same inventor.

A gate for railway crossings has been patented by Mr. Abiud G. Miller, of Leyden, N. Y. It has posts at opposite sides of the roadway, bars pivoted to the posts, the lower bar normally vertical and the upper extending horizontally toward it, with a flexible connection between the free ends of the bars, with other novel features, making an inexpensive safety gate which may be operated quickly and easily in all weathers.

NEW BOOKS AND PUBLICATIONS.

SACRED MYSTERIES AMONG THE MAYAS AND THE QUICHES, 11,500 YEARS AGO. By Augustus Le Plongeon. New York: Robert Macoy, 1886.

At the close of the ceremony of initiation into the Grecian mysteries, the candidates were dismissed with three cabalistic words, which, curiously enough, had no meaning in any tongue known to the mystic priesthood. Dr. Le Plongeon has discovered that these words are Maya, and are not only perfectly intelligible, but are appropriate to the dismissal of the newly initiated. Starting with this discovery, he attempts to show that the origin of Freemasonry dates back to the ancient civilization of Central America, to the Mayas and Quiches of 11,500 years ago. He traces the relation of their sacred mysteries to those of Egypt, Greece, Chaldea, and India, and gives an interesting account of his explorations among the ruins of the Maya temples. The work is illustrated with drawings and prints from photographs made by the author.

CANADA: ITS HISTORY, PRODUCTIONS, AND NATURAL RESOURCES. Prepared under the Direction of the Minister of Agriculture. Ottawa: Department of Agriculture, 1886.

The present handbook of Canada has been prepared by Mr. George Johnson, for the purpose of the Colonial and Indian exhibition now in progress in London, and furnishes, in a limited space, an excellent *resume* of the resources of that Dominion. The climate, area, system of government, industrial enterprises, commerce, and other features essential to the interests of the country are briefly reviewed, and will give the other members of the British Empire a very good idea of the development and future possibilities of their sister province in the Western Hemisphere. The book will also prove useful to those who contemplate a Canadian tour, and who desire to inform themselves of the chief characteristics of the country they are about to visit. Two large maps accompany the volume.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Cheap Swift Ferries.—Propelled by current; submerged cable; no obstruction to navigation; boy can manage. *Wagon-way* (cheap railway).—Serves for light steam cars and a toll road for ordinary vehicles; effects enormous saving in haulage, especially for sandy and muddy sections. *Shifting-outrigger Yachts.*—Tack and turn, and far outstrip any other, or no pay. *Toboggan.*—Roller sleds for summer coasting. *Simplifying Cities.*—Naming streets by system instead of at random. Stewart & Co., Engineers and Promoters (of tried inventions only), 3041 Dauphin St., Philadelphia. *Business men* looking for paying improvements should address us. We cull from all countries.

Brass and Iron Working Machinery, Die Sinkers, and Screw Machines. Warner & Swasey, Cleveland, O.

Emery Wheels of unusually superior quality for wet grinding. The Tanite Co., Stroudsburg, Monroe Co., Pa.

A Catechism on the Locomotive. By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. $2.50. Sent on receipt of the price by Munn & Co., 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

"By medicines life may be prolonged,
Yet death will seize the doctor, too."

True, all must die, yet few must suffer while they live. Stop pain and prolong life, by taking Dr. Pierce's "Golden Medical Discovery," a cure for consumption (which is scrofula of the lungs), as well as for coughs, colds, bronchitis, catarrh, and a specific in liver complaints, scrofula, and all blood and skin diseases. Sold everywhere.

Empire Gum Core, Soap Stone, Rubber, and all kinds of Packing. Greene, Tweed & Co., 83 Chambers St., N. Y

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 98 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y

Curtis Pressure Regulator and Steam Trap. See p. 142.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Nystrom's Mechanics.—A pocket book of mechanics and engineering, containing a memorandum of facts and connection of practice and theory, by J. W. Nystrom, C.E., 18th edition, revised and greatly enlarged, *plates*, 12mo, roan tuck. Price, $3.50. For sale by Munn & Co., 361 Broadway, New York city.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Chucks—over 100 different kinds and sizes in stock. Specials made to order. Cushman Chuck Co., Hartford, Ct.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., New York city.

Veneer Machines, with latest improvements. Farrel Fdry. & Mach. Co., Ansonia, Conn. Send for circular.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Greene, Tweed & Co., Railroad and Manufacturers' Supplies, have removed to 83 Chambers St., city.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 30.

Emery and Corundum in quantity to suit. Walrus and other leather for polishers. Greene, Tweed & Co., N. Y.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) R. M. R. asks: How is the ink made that is used in inking the official indelible ribbon in type writers, which writes black, but copies a very dark blue? How is the ribbon prepared with this ink? A. We presume you refer to the blue record ink, which is made as follows: Take vaseline of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much Prussian blue as it will take up without becoming granular. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum benzine and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small quantities by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistency of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspapers, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a stiff tooth-brush. Hardly any ink should remain visible on the surface.

(2) W. M. M.—Pear trees are subject to two kinds of blight, one due to insect agency, and the other to fungi. In the case you instance the trouble was probably caused by the insect whose larva you send us.

(3) W. D. S. asks: Which is the oldest city—St. Augustine, Fla., or Santa Fe, N. M.? A. Santa Fe, N. M., is the older city. When visited for the first time by the Spaniards in 1542, it was already a populous Indian pueblo. The fort built by Menendez in 1565 on the site of St. Augustine, Fla., was the first habitation in that city of which we have any record. In spite of these facts, St. Augustine is usually spoken of as the oldest city in the United States.

(4) S. F. W.—Steel, as now made for boilers, is far superior to iron in all respects; it is stronger for the same thickness, tougher in bending, uniform in grain in every direction and not liable to blister. The cylinders of Corliss engines are proportioned to their work and speed, and supposed to be about the best in modern engineering. They are recommended for economy and durability for all work.

(5) R. L. S. asks the advantages in coking coal, which is now so extensively done at the mines before shipping to consumers. A. We do not know that there are any advantages in point of economy of cost over bituminous coal. Cleanliness in firing and a smokeless fire are always desirable if at not too much cost. The great value of coke is in the blast furnaces and the great coking establishments of Western Pennsylvania were originally established to meet this requirement. Competition in manufacture has thrown it into market for general consumption. 2. How is it that the common buzzard, and some other species of hawks, are able to float through the air without moving their wings or making any apparent effort, raising and lowering themselves at pleasure, even propelling themselves against the wind, while their wings are, seemingly motionless? A. When moving against the wind they sometimes appear to be motionless, for a few moments, but sustained in the same manner as a kite, the distance making them appear motionless when they are moving slowly. When they are sailing in a calm, they are always moving on an inclined path. It is our upward view which deceives us. When seen from the top of mountains their real motions are apparent. They gain speed on the downward sail and use it as momentum in nearly gaining their original level.

(6) Subscriber asks: Can you inform me of a combination of chemicals which will produce a degree of cold, say 20° or lower, which will continue for several hours, the said chemicals to be cheap and free from danger? A. We recommend ammonium nitrate and water as the simplest. Or, as a more complicated mixture, try the following:

Sodium sulphate	6 parts by weight.
Ammonium nitrate	5 " " "
Dilute nitric acid	4 " " "

The last formula is very powerful, but has the objection of requiring the use of acid.

(7) C. C. B. asks: 1. What is the best material for a non-conductor to put between the registers and wood for a hot air furnace? A. Soapstone frames to set the register in are the best. 2. Of what metals and what proportion are counterfeit silver dollars made of, and the quickest way to detect them? A. The composition of counterfeit dollars varies a good deal. Detect them by their lightness and absence of ring; also, by the appearance of the die work. 3. Would you suggest Kansas as being a good place for a machine shop? A. Kansas is a large agricultural State, with a population of over a million. There is room for a good number of machine shops, but we do not know how well the demand is filled. 4. What is best to administer to assist nature in cases of diphtheria and fevers? A. For the treatment of diphtheria, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 281, 50, 309, 51, 125, 249, 373. For the treatment of fevers, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 358, 229, 172, 251, 143.

(8) W. W. B. asks (1) how to best raise a pine pole measuring 50 feet in length and about 6 inches in diameter at tip end, pole to be put in a hole 4 to 5 feet deep. A. Such a pole should be easily raised with pikes and guy ropes, placing its foot against a plank set in the hole. A small trench may be cut, so that the foot of the pole will rest against the plank below the surface of the ground. The telegraph poles are raised in this manner. 2. About how many Leclanche cells will be required to run a current (sufficiently strong to ring a call bell) through four miles of barb wire, the wire being stapled to fence posts? A. 2 to 4 cells, according to perfection of insulation. Satisfaction will only be obtained in dry weather.

(9) F. D. L. asks: Which moves first in starting a steam engine—the valve or piston? A. Being connected with the shaft, they both move at once. The motion of each has an infinitesimal stop on the centers. In this manner the valve may stop while the piston is moving. The valve nut is often loose, so that the valve stops an appreciable time at the change of stroke.

(10) G. B. asks the best material for small gear wheels about 12 inches in diameter, running at a speed of about 500 revolutions. A. Cast iron is universally used. For fast running gear, the teeth should be cut.

(11) T. S. asks: What is the best steam packing for a stuffing box of a rotary spindle? A. Cotton wicking saturated with plumbago and oil is as good as anything.

(12) L. M. asks: 1. Is it necessary to balance a three cylinder, high speed, upright, double acting engine where the cranks are at 120 degrees apart? A. No. 2. Is it necessary to balance a three cylinder, high speed, upright, single acting engine, the cranks also at 120 degrees apart, and where the steam is at the top of pistons? A. Yes.

(13) J. M. A. asks how sulphurous acid may be made without much expense, and what apparatus would be needed? A. By treating hyposulphite or sulphite of soda with dilute sulphuric acid gas comes off freely, and should be received in pure water, which dissolves it and forms sulphurous acid. A bottle with perforated cork and an eduction tube is all that is required.

(14) F. W. S. writes: I would like to make a small induction coil for taking shocks. I have about 6 ounces No. 31 copper insulated wire, which I would like to use for the secondary coil. Will you please tell me what size and about how much wire I will need for the primary coil, and what size spool it will make? A. Use a bundle of wires a quarter of an inch thick and 2½ long for core. On these wind one hundred feet No. 16 to 18 insulated wire, and on this the fine wire. Use layers of shellacked paper between the core and primary and between primary and secondary.

(15) E. B. D. asks in regard to the construction of Leyden jars? Say we use gallon jars. 1. How thick should the glass be? A. About ⅛ inch. 2. What is the best method of coating the jar with tin foil? A. Paste the tin foil on with flour paste over two-thirds the height of the jar and over the bottom, inside and outside. For inside use it in strips.

(16) A. E. S. writes: If a sphere of average wrought iron weighing 1 ton with a vacuum that renders it without specific gravity be filled with air, will the sphere be made heavier or lighter? And how much per atmospheric pressure? A. A vacuum does not deprive a substance of specific gravity. A hollow with vacuum within it is lighter than when filled with air; how much, depends on the volume of air introduced, which is not given in your question.

(17) C. W. H. says: I wish to construct a battery and lamp for an electric light to be used in connection with a microscope to throw an image upon a screen about 8 feet square. 1. Please explain construction of battery and lamp. I have a telegraph battery, 12 cups; can that be used? A. You need a much higher electro-motive force than 12 gravity cells will give. The lamp you can buy of Stout-Meadowcroft Co., 21 Ann Street, New York. They supply battery, lamp, and all for this express use. 2. I have a small medical battery in which I use sulphate of mercury; can a larger battery of that style be used? A. It could, but would be expensive to run.

(18) W. B. writes: I have four large gravity battery cells, half a mile of No. 18 cotton-covered magnet wire, and desire with these to make a powerful magnet. Please tell me how big should the soft iron core be. What is the best iron—cast or wrought? Need I put any insulator on the magnet before wrapping with wire, and is anything required between the layers? A. Use cores 1¼ round iron (Norway annealed), and about 10 inches long. Wind the wire on pasteboard tubes large enough to slide over the covers. Use two tubes for each leg, and wind each tube with a double layer. This gives you a number of combinations, to suit different battery strengths. Nothing more is required than wrapping of wire as an insulator.

(19) H. E. W. asks whether cotton seed oil is combustible; if so, what degree of heat it requires to explode it. Some of the Northern mills have been advised not to handle it, on account of its spontaneous combustibility. A. Cotton seed oil is not explosive in the ordinary sense. Mixed with waste, wood shavings, and the like, it is liable to heat, and so catch fire spontaneously. We should apprehend no more danger in handling it than in the case of linseed oil.

(20) G. H. A. says: I have lately made a workshop of an upper room, and have put in a lathe, boiler, and engine of a total weight of 2,400 pounds, resting upon 3 joists 3 inches by 9 inches by 16 feet 0 inches. Will it strengthen the floor sufficiently to enable it to carry the increased weight if I bolt three 3 inch by 8 inch joists to the existing ones? A. You had better use 4 inch by 8 inch joists bolted with ¾ inch bolts about 10 inches apart. Take care to provide solid bearings for your new joists, wedging the ends up with tiles in cement.

(21) F. B. M.—The resistance to thrust in the case referred to depends upon the adhesion between the mortar and bricks, and varies from 12 to 24 pounds per square inch. Taking it at 20 pounds per inch, and the approximate resistance to thrust 300 inches we have 53⅓ cwt., the thrust required to break the wall. The thrust of the beam mentioned would be as follows: Taking 5⅓ cwt. per square for framing and 7½ cwt. for slates, we have 33 cwt. direct thrust. This is neglecting the wind pressure, which in steep roofs is usually calculated at 36 cwt. per square, bringing the thrust up to 124 cwt.

(22) W. B. asks: How many batteries (bichrom. bat.) will it take to run a seven candle power incandescent lamp? Carbon and zinc are 8 by 4 inches. A. 10 to 15 such cells, run as they probably would be in practice.

(23) A Subscriber asks: Will you give me a few points about the electro magnet that appeared in vol. liv., No. 7, February 13, 1886? 1. What is the electromotive in volts and amperes necessary to run the electric motor illustrated in SCIENTIFIC AMERICAN, vol. liv., No. 7? A. About 50-70 volt-amperes. 2. The number of layers of wire used, and what is the weight of it? A. This depends on the exact size. Two or three pounds of wire should suffice. 3. What is the width and the thickness of the armature? A. Make the armature about¶ inch wide by ½ inch thick. 4. Should E project above flange the thickness of the armature? A. Make it project about ¾ inch for stroke of 1 inch. 5. In winding the bobbin, where should the wire start and end at? A. Immaterial. 6. Is the commutator made of iron too? A. Make commutator of copper or brass.

(24) M. A. asks if one of the materials used in the manufacture of fireworks is meal powder. What is meal powder? A. It is powder that has been mixed and rolled, etc., but not yet compressed and granulated.

(25) L. A. writes: Want to know if there are any chemicals that will produce a gas and create a pressure, so that the said gas can be used expansively the same as steam? A. There many chemicals that will do it. Limestone and muriatic acid will produce any pressure ordinarily required by evolving carbon dioxide gas.

(26) C. E. M. asks: 1. What is the amount of wire to be used in the dynamo described in SUPPLEMENT, 161? Also, how much (if any) candle power can it give with incandescent lamp? A. Five to six pounds in the field, and half pound in armature. It will give five to ten candle illuminating power. 2. I would also like to know the power of a steam engine which I have constructed (it is horizontal). The bore is 1 in., stroke 2 in., pressure 65 lb., speed 120, size of ports ⅛ in. round. A. If your speed is 120 revolutions per minute, it gives six one-hundredths of a horse power; if the speed is 120 strokes per minute, it is one-half that amount, or three one-hundredths horse power.

(27) W. Z. asks: In a telegraph sounder the core of coils and bar of armature are nickel plated. Is the attractive power lessened by the nickel coating, and would it be better to have them bare iron where close together (on armature opposite core)? A. The nickel plating should not affect the working to any perceptible extent.

(28) H. S. P. asks: 1. How to take mildew out of a tent? A. Mix well together a spoonful of table salt, two of soft soap, two of powdered starch, and the juice of a lemon. Lay the mixture on both sides of the stain with a painter's brush, and then expose the tent out of doors day and night until the stain disappears. 2. How to make an emery wheel? A. Take a solid wheel of pine or any similar wood, and of the proper size. Turn the wheel true. Then prepare some best glue, and using it hot and thin, put it on the surface of the wheel with a brush. The first coat of glue should be a light one, and when it is dry a second one should be applied, and, as quickly as possible, as much emery should be sifted upon the wet surface as the glue will hold. When this is dry, another coat of glue and emery should be applied in the same way. See also the article on "Polishing Materials," contained in the SCIENTIFIC AMERICAN for Jan. 17, 1885.

(29) J. W. P. writes: I wish to boil a cigar holder to clean it out. What kind of oil should I use, etc.? A. The best thing to use is alcohol. Care must be taken to prevent this solvent from coming in contact with the outside of the meerschaum. All processes for coloring must be done by experts. These workmen keep their processes secret, and there are not more than two or three persons in the United States who are competent to do it.

(30) W. A. B. asks: 1. Is there an explosive compound known as glucodine? A. Glucodine is no longer manufactured. 2. Which possesses the greater destructive power, weight for weight—No. 1 dynamite or fulminate of mercury? A. Fulminate of mercury is the most intense, and therefore most local. 3. Why are not the higher explosives used in heavy artillery? A. Because they would destroy the guns. Progressive force is desired in artillery practice.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 29, 1886

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abdominal and spinal brace, W. B. Dowes 344,539
Aerated beverages, apparatus for manufacturing, O. Brunier 344,562
Aerated drinks, portable apparatus for making and supplying, G. W. Chinnery 344,439
Air accumulator, auxiliary, M. P. Drummey 344,571
Air and gas, apparatus for and process of supplying, G. E. Benninghoff 344,536
Alarm. See Burglar alarm. Fire alarm.
Amalgamator and concentrator, combined, B. Tyson 344,797
Animal trap, S. Snell 344,551
Animals, device for exterminating ground burrowing, M. Scholl 344,692
Apple slicer, Humphrey & Bush 344,379
Arc light, W. E. Freeman 344,802
Axle box, car, J. Petithomme 344,601
Bag. See Mail bag. Traveling bag.
Bag and twine holder, combined, J. Cushing 344,771
Bag frame clasp, F. F. Braillard 344,437
Bag holder, Hollingsworth & Broyles 344,738
Bales, jack for replacing ties upon, J. B. Johnson 344,659
Baling machine, B. J. Leslie 344,486
Banjo frame, M. Dobson 344,569
Bar. See Car strengthening bar.
Basin or similar fixture, set, J. P. Putnam 344,496
Basket, cotton, D. C. Barrow 344,340
Bat, racquet, I. T. Townsend 344,422
Bearing, anti-friction, M. Gale 344,573
Bell, door, R. A. Wooding 344,703
Belting, J. D. Channell 344,563
Blacking box, C. C. Johnston 344,447
Blind, movable slat rolling, A. Wulff 344,709
Block. See Building block.
Boat. See Submarine boat.
Bobbin, C. M. Currier 344,770
Bobbin winding machine, G. Scheibler 344,691
Boiler. See Wash boiler.
Boiler for house warming apparatus, R. S. Watson 344,699
Boot and shoe cleaner, C. Goldthwait 344,745
Boot, felt, D. Beatty 344,613
Boot or shoe, button, W. E. Bennett 344,710
Boot, shoe, or stocking, felt, J. Brandy 344,438
Boots, etc., machine for forming bats for felt, Messer & Woodbury 344,589
Bottle stopper, C. D. Quillfeldt 344,628
Box. See Axle box. Blacking box. Fare box. Letter box. Stuffing box.
Box, H. P. Fiske 344,807
Box, nailing machine, J. H. Swift 344,419
Brace. See Abdominal and spinal brace.
Brake. See Car brake. Electrical train brake. Tricycle brake.
Brick, ornamental, J. C. Anderson 344,707
Brick or tile having roughened, drused, or variegated appearance, J. C. Anderson 344,705
Bricks, composition for the treatment of the surfaces of, A. M. Long 344,709
Bridle blind and loop, combined, H. J. Noyes 344,456
Brush and comb, combined hair, Leyburn & Laughlin 344,664
Brushes, machine for making, J. Earnshaw 344,793
Buckle, T. Haswell 344,775
Building block, Popp & Melchior 344,594
Building section, separable, H. Mulhollen 344,747
Burglar alarm, L. E. Cosby 344,650
Burglar alarm, electric, S. T. Dickens 344,558
Butter, testing factitious, L. Fagersten 344,780
Button, R. H. Lewis 344,743
Button fastener, E. Kempshall 344,595
Button or stud, C. H. Wood 344,709
Buttons, machine for fastening, S. Schwab 344,690
Cable grip, Samuel & Angerer 344,566
Calendar, E. N. Heath 344,776
Calculator, J. V. Charpentier 344,634
Cane and whip, combined walking, R. M. Thomas 344,737
Cans, unsoldering and cleaning tin, J. W. Bradshaw 344,561
Cap, C. Freschl 344,368
Capsule machine, J. Krehbiel 344,788
Car brake, W. H. Tice 344,696
Car brake and starter, J. S. Labs 344,784
Car coupling, R. L. Boyers 344,715
Car coupling, H. H. Campbell 344,719
Car coupling, M. R. Hubbell 344,780
Car coupling, H. W. Johnstone 344,658
Car coupling, F. N. Kelsey 344,382
Car coupling, Lawson & Bailey 344,387
Car coupling, E. O. Sawyer 344,509
Car coupling, Thrush & Aura 344,695
Car coupling, I. Tillson 344,420
Car door, freight, E. Y. Moore 344,746
Car wheel, J. K. Sax 344,547
Car wheel and axle, P. Cook 344,768
Cars, apparatus for distributing coal in, R. Ramsay 344,505
Carpet fastener, W. T. Merserean 344,385, 344,394
Carriage gear, E. Squires 344,689
Carrousel, R. Steel 344,759
Cart, water, S. B. Sherer 344,684
Case. See Violin case.
Caster, N. Drucker 344,728
Casting car wheels, W. Wilmington (r) 10,742
Cereals, food products from, Boynton & Van Patten 344,717
Chair. See Surgical chair.
Chenille pendant, B. Dreyfus 344,570
Chimney and flue cleaner, J. H. Rowlett et al. 344,660
Chimney cowl, N. Clifford 344,565
Churn, C. A. Madsen 344,584
Churn, barrel, J. Smith 344,503
Cigar cutter, B. D. Eilers 344,302
Clamp, G. Blythe 344,713
Clamp or holder, A. L. Hallbauer 344,651
Clasp. See Bag frame clasp.
Clasp and file, M. H. Kiebel 344,394
Cleaner. See Boot and shoe cleaner. Chimney and flue cleaner.
Clock movement, F. A. Lane 344,584
Clocks, record sheet for the dials of watchmen's time, O. E. Hausburg 344,479
Clothes drier, I. V. Cooley 344,628
Clothes line prop, M. Raughtigan 344,402
Clothes wringer, M. N. Lovell 344,745
Clutch coupling, B. F. Applegate 344,611
Clutch mechanism, ratchet, E. P. Howe 344,598
Coal box, A. W. Tipton 344,750
Coal, etc., machine for washing, B. Robinson 344,545
Coffee, apparatus for treating, A. L. Saint-Aubin 344,507
Coffee roaster, J. Levy 344,398
Compass faces, instrument for engraving, V. L. Ourdan 344,676
Concentrator, Clayton & Mackie 344,620
Condenser, jet, L. Schutte 344,502
Core strengthening bar, E. Niver 344,398
Corkscrew, J. H. Cluever 344,566
Corkscrew, W. B. Woodman 344,556
Corn, machine for cutting and bunching, Z. T. & B. F. Parker 344,400
Corn meal and buckwheat flour, manufacturing, J. M. Case 344,518
Cotton and corn scraper and cultivator, T. W. Boyle 344,716
Coupling. See Car coupling. Thill coupling.
Cowl. See Chimney cowl.
Cuff fastener, S. V. Thomas 344,695
Curling iron, R. P. Dunn 344,774
Curtain pole and fixture, O. F. Schumann 344,461
Cutter. See Cigar cutter.
Damper, furnace, W. E. Walker et al 344,589
Dental breath guard, C. P. Southwell 344,688
Door check, G. N. Clemson 344,564
Doors, apparatus for opening, E. A. Babcock 344,536
Draught equalizer, J. D. White 344,702
Draught regulator for hot air furnaces, J. R. Barker 344,559
Drawers, M. R. House 344,481
Drier. See Clothes drier. Fruit drier.
Drill. See Lemon drill. Rock drill.
Drinking straw or tube holder for tumblers and other glasses, W. E. Coleman 344,567
Drum, beating, Sherman & Anderson 344,414
Electric batteries, zinc for, W. S. Platt 344,750
Electric conductor, suspended, C. J. Van Depoele 344,625
Electric conductors, conduit for, H. Fondersmith 344,737
Electric light reflector or reflectors, W. A. Jones 344,523
Electric machine, dynamo, W. E. Freeman 344,801
Electric machine, dynamo, C. A. Parsons 344,542
Electric motor, C. Doriot 344,643
Electric motor, E. F. Recordon 344,679
Electrical apparatus, connecting clip for, M. M. Slattery 344,417
Electrical conductors, housing for, A. T. Woodward 344,764
Electrical train brake, H. Hinckley 344,786
Electroplated fabric, R. F. Nenninger 344,397
Elevator, U. P. Smith 344,687
Elevators, hand device for the shipper or hand rope of, Wordon & Grover 344,557
Engine. See Gas engine. Rotary engine. Steam engine.
Evaporating liquids, apparatus for, S. M. Lillie 344,566
Eyeglasses, L. Bitzer, Jr 344,618
Fabric. See Electroplated fabric.
Fare box, W. T. Dryden 344,729
Faucet, J. R. Underwood 344,595
Feed rack, L. D. Wallace 344,426
Feed water heater, I. D. Small 344,686
Fence, J. M. Kelly 344,669
Fence, W. F. Shedd 344,413
Fence, barbed, Whitney & Hubbell 344,438
Fence wire, machine for winding or stretching, J. H. Corcoran 344,629
Fence wire tightener, T. C. Histed 344,576
Fence wire tightener, A. J. Upham 344,697
Ferments, organic (non-organized), M. Blumenthal 344,433
Fifth wheel, E. Storm 344,756
Fire alarm and extinguisher, automatic, W. Neracher 344,673
Fireplace, ventilating, N. Poulson 344,750
Fireproof coating building material, etc., composition of matter for, W. Schimmelpfeng 344,409
Flanging tool, J. D. McDougal 344,666
Footlights, extinguishing device for, H. Funk 344,776
Frame. See Banjo frame.
Fruit drier, J. R. Deadmore 344,637
Fruit extractor, L. K. Strang 344,508
Furnace. See Smoke burning furnace.
Furnace stoker, T. Cranny 344,631
Gauge. See Saw gauge.
Galvanic battery, W. L. Gates 344,523
Galvanic cells, regenerating exhausted, W. E. Case 344,346
Garment stand, O. Borchert 344,516
Garments, stiffening and distending spring for, V. H. Buschmann 344,707
Gas burners, automatic cut-off for, Warner & Pelisse 344,510
Gas combustion apparatus, Konold & Hays 344,396
Gas engine, J. H. Clark 344,440
Gas mains, detecting and carrying off leakage from, G. Westinghouse, Jr 344,705
Gas mains, pipe coupling for, F. Crocker 344,732
Gas regulator, H. L. & W. L. Harris 344,654

Gate. See Railway crossing gate. Railway gate.
Gearing for operating straw cutters, chop grinders, and corn shellers, J. W. Emenhiser 344,365
Generator. See Steam generator.
Glass can cap, Otterson & Voorhies (r) 10,741
Glass crimping machine, W. Leighton, Jr 344,585
Glassware and finishing the same, F. S. Shirley 344,415
Glassware, mould for hollow, H. C. Schrader 344,500
Grain, device for trimming, M. F. Seeley 344,402
Grate, L. T. Burnham 344,766
Grate, J. Murphy 344,491
Grinding and polishing machine, J. R. Donnelly 344,359
Grinding mill, R. Morrell 344,490
Guard. See Dental breath guard.
Gun carriage for revolving turrets, T. R. Timby 344,758
Handle. See Tool handle.
Hanger. See Pipe hanger.
Hame fastener, J. P. Duthie 344,360
Hammocks, suspension device for, I. E. Palmer 344,495
Harrow, W. E. McCann 344,695
Harvester reel, O. Cooley 344,441
Hat brim heater, G. Yule 344,800
Hat holder, F. A. Wood 344,555
Hat sizing machines, drum or roll for, C. H. Reid 344,680
Hay loader, Overing & Livingston 344,789
Head rest, J. W. Trussell 344,796
Head rest, portable adjustable, G. E. Dolton 344,726
Heat energy into electrical energy, apparatus for converting, W. E. Case 344,345
Heat energy into electrical energy, converting, W. E. Case 344,347
Heat producing apparatus, Benninghoff & Jewell 344,615
Heater. See Feed water heater. Steam heater.
Heating and cooking device, combined, Q. S. Backus 344,511
Heel and sole protector, F. J. Herrick 344,526
Heel nailing machine, F. F. Raymond, 2d 344,499
Hoe and rake, F. Middleton 344,569
Holder. See Bag and twine holder. Drinking straw or tube holder. Hat holder. Lantern holder.
Hook. See Lacing hook.
Hoop fastening, J. O'Neill 344,749
Horseshoe, L. B. Melius 344,452
Hose carriage, D. T. Young 344,705
Hose reel, C. H. Weygant 344,554
House. See Ice house.
Hub runner, H. Holland 344,579
Hub runner for carriages, H. Holland 344,578
Ice creeper, McConnell & Harbster 344,695
Ice house, J. O. Beck 344,614
Illumination, electric, C. E. Buell 344,344
Incubators, heat regulating attachment for, J. W. Campbell 344,474
Ingot mould cover, A. J. Lustig 344,451
Injector, W. L. Cheney 344,475
Injector, H. Holden *et al* 344,480
Iron. See Curling iron.
Ironing machine, corset, D. Grotta 344,778, 344,779
Jack. See Lifting jack.
Key. See Telegraph key.
Key fastener, C. A. Singer 344,416
Knife. See Leather splitting machine knife.
Lacing hook for shoes, G. H. Davis 344,636
Lamp, electric arc, C. Dorlot 344,642
Lamp, electric incandescent, C. E. Buell 344,343
Lamp support, electric, G. J. Hammerstein 344,652
Lamps, holder for incandescent, Thomson & Rice, Jr 344,632
Land roller, J. Mott 344,591
Lantern holder, E. C. Geneux 344,649
Lasting machine, W. C. Cross 344,725
Latch, door, J. K. Clark 344,722
Lathe, W. W. Hubbard 344,580
Lathing, metallic, L. W. Newton 344,592
Lathing, metallic, B. Searles 344,408
Leather splitting machine knife, C. E. Roberts 344,404
Lemon drill, W. F. Moulton 344,672
Letter box, J. McLane 344,489
Lifter. See Pan and stove cover lifter.
Lifting jack, A. A. Strom 344,794
Light. See Arc light.
Lock. See Nut lock.
Locomotive ash pan, E. F. Vaughn 344,608
Loom, needle, L. Woodbury 344,470
Loom shuttle, A. Claus 344,625
Loom shuttle, L. Goddu 344,569
Loom shuttle binder, C. H. Knapp 344,450
Lubricating device, crank pin, J. H. Emery 344,364
Mail bag, L. W. Freeman 344,775
Mail bags, device for attaching and detaching wood labels to, J. C. McKenzie 344,488
Measuring wheel, J. L. McCaleb 344,536
Mechanical movement, S. Devisme 344,357
Metal grinding machine, automatic, G. M. Griswold 344,777
Mill. See Roller mill. Rolling mill. Windmill.
Mineral waters for transportation, preparing, L. H. Barkdull 344,708
Mining machine, coal, W. A. Wright 344,610
Moulds, device for forming beads in sand, C. B. Isbester 344,657
Mop, T. Moored 344,454
Motor. See Electric motor. Water motor.
Muffs, device for blocking, J. A. Spitzer 344,752
Musical instrument, M. Gally 344,696
Musician's exercising device, A. K. Virgil 344,462
Musician's exercising key board, A. K. Virgil 344,464
Musicians' finger exercising devices, speaking spring for, A. K. Virgil 344,463
Nail extractor and box opener, combined, O. S. Harmon 344,655
Nippers, cutting, G. L. Donovan 344,641
Nut lock, D. A. Johnson 344,580
Oil cans, lamp filling attachment for, J. M. McFarland 344,538
Oils, separating solid paraffine from, G. T. Beilby 344,709
Ores, machine for concentrating, F. R. Carpenter 344,720
Organ reed, M. Gally 344,443
Ovens, drop door for, L. L. Culver 344,521
Padlock, F. W. Mix 344,669
Pails, bail ear for, J. McDonnell 344,697
Pan. See Locomotive ash pan.
Pan and stove cover lifter, combined, P. A. Gordon 344,524
Pants, supplementary waistband for, B. Birnbaum 344,741
Paper, machine for hanging, R. Haskell 344,574
Papers, maps, etc., case for, S. H. Harrington 344,444
Photographic negatives, producing impressions in line or stipple from, J. Gast 344,648
Photographic sheets, burnishing remounted multiple, O. L. Hulbert 344,781
Piano music rack, Kranich & Bach 344,485
Pianos, action rail for, C. D. Pease 344,677
Pipe coupling, A. Wilbur 344,760
Pipe cutter, J. W. Mahlon 344,487
Pipe hanger, J. T. Kelly 344,483
Pipe joints, application of cement to, W. Rowbottom 344,407
Pipe, mechanism for screw threading, Bowden & Benchley 344,714
Pipe stems, etc., machine for bending, C. B. Hopkins 344,739
Pipe wrench, S. A. Rouse 344,406
Planter, check row corn, J. Frazure 344,573
Planter, check row corn, R. Smith 344,550
Planter, corn, A. L. Shipman 344,685
Planter, potato, C. C. Maves 344,535
Plastic and netting lining or finish for partitions, etc., combined, E. C. Morris 344,671
Plastic and wire netting lining or finishing for partitions, compound, E. C. Morris 344,670
Pliers, W. Cronk 344,769
Plow, M. J. Hatcher 344,656
Plow and stalk cutter, rotary, E. Royce 344,596
Plow attachment, C. C. Trinkle *et al* 344,795
Plow attachment, M. L. Unger 344,424
Plow or cultivator, rotary, E. Royce 344,791
Pressure gauge, recording, F. A. Jones 344,448
Printer's galley, G. E. Jones 344,741
Printing machine sheet delivery apparatus, G. P. Fenner 344,731
Printing machines, sheet delivery apparatus for, C. Potter, Jr 344,497
Printing machine, stop cylinder, C. Potter, Jr 344,496
Printing machine, stop cylinder, S. D. Tucker 344,507
Prison, J. Erb 344,644
Protector. See Heel and sole protector.
Pull handle, O. Bernz 344,617
Pump, combined suction and force, M. Harrold 344,445
Rack. See Feed rack.
Rail bender, A. A. Strom 344,793
Rail breaking machine, A. Hill *et al* 344,735
Rails, rolls for rolling girder, A. J. Moxham 344,336
Railway crossing gate, A. G. Miller 344,540
Railway gate, Groninger & Jacobs 344,571
Railway grip cable, H. M. Lane 344,583
Railway point and signal levers, apparatus for actuating interlocking gear for, H. Johnson 344,482
Railway switch, J. Quinn 344,544
Railway track, W. S. Meisenheimer 344,539
Reel. See Harvester reel. Hose reel.
Register front, C. G. Dobbs 344,640
Releasing device, W. H. Neun 344,674
Roads, machine for making, repairing, and cleaning, G. W. Taft 344,630
Roaster. See Coffee roaster.
Rock drill, G. R. Cullingworth 344,477
Rock drill machine, A. N. Townsend 344,421
Roller. See Skate roller.
Roller mill, W. Bauer 344,472
Roller mill, E. G. Dewald 344,478
Rolling mill, Kennedy & Aiken 344,383
Rolling mills, roll for, Reed & Holloway 344,401
Rotary engine, Baker & Huyck 344,339
Salt grainer, T. Craney 344,632, 344,633
Salt making apparatus, T. Craney 344,634
Sash balances, spring roller for, A. E. Cohn 344,626
Sash cord fastener, S. E. Nies 344,748
Sash fastener, M. Bourke 344,436
Saw gauge, W. H. Wilson 344,469
Sawmill dog, Delaney & Bond 344,355, 344,356
Sawmill set works, C. Esplin 344,366
Saw setting device, H. C. Hart 344,655
Sawing machine, circular, E. S. Collins 344,598
Scaffold, T. C. Goudie 344,734
Scale for measuring gas pipe and fittings, W. L. Cheney 344,721
Scale for weighing vehicles, portable, L. R. & E. A. Witherell 344,702
Scoop, wooden, N. E. Nichols 344,541
Semaphore, Stiltzel & Weinedel 344,755
Semaphore signal, F. I. Myers 344,404
Settler, Clayton & Mackie 344,519
Sewing machine, L. Muther 344,493
Sewing machine, automatic tension, A. A. Bouton 344,765
Sewing machine, buttonhole, E. M. Phelps 344,678
Sewing machine tension release, R. W. Whitney 344,429
Sewing machines, carpet rag attachment for, C. W. Chamberlin 344,348
Sheet metal articles, drawing, Paull & Butters, 344 457 to 344,459
Sheet reversing apparatus, L. C. Crowell 344,352
Shipping cases, fastener for, W. G. Bond 344,473
Shirt, J. Schlesinger 344,548
Shoe uppers, machine for beading, Q. W. Booth 344,435
Show case, J. Irons 344,582
Sifter, coal, ash, or gravel, Seeley & Langley 344,693
Sign, H. L. & W. L. Harris 344,575
Signal. See Semaphore signal.
Signal apparatus, municipal, J. C. Wilson 344,467
Siphon recorder, C. Cuttriss 344,772
Skate roller, S. C. Mendenhall 344,454
Sled, E. M. Deane 344,354
Sled runner, F. B. Wahmhoff 344,697
Sleigh, bob, M. B. Bertrang 344,711
Sleigh, shoe, I. B. Seeley 344,691
Smoke burning furnace for steam boilers, W. T. McDonald 344,537
Snow plow, H. S. Rollins 344,405
Sole leveling machine, O. Gilmore 344,650
Spark arrester, J. R. McCormick 344,391
Speaking springs, producing, A. K. Virgil 344,465
Spinning machines, etc., top roll for, J. Booth 344,434
Spoke socket, O. L. Neisler 344,455
Spoons, manufacture of, W. Bradel 344,517
Spring. See Vehicle spring.
Squeezer and strainer, W. A. Johnson 344,446
Stamp, hand, B. B. Hill (r) 10,740
Stamp, hand, F. M. Ironmonger 344,581
Stanchion, C. E. Walton 344,553
Stand. See Garment stand.
Starch and other substances, treating, J. C. Schuman 344,410
Starch, manufacture of, J. C. Schuman 344,411, 344,412
Starching machine, C. Lehmann 344,662
Steamboat, C. M. Catlin 344,621
Steam engine, H. F. Bayne 344,472
Steam engine, G. L. Peabody 344,593
Steam generator, T. Craney 344,635
Steam generator, J. A. Eno 344,522
Steam generator and superheater, R. A. Chesebrough 344,476
Steam heater, Q. S. Backus 344,512
Steam heating apparatus, J. J. Flynn 344,645
Steering and coupling apparatus, boat, L. Balletto 344,612
Steering gear for vessels, C. M. Catlin 344,623
Stitching, forming elastic, L. Muther 344,492
Stocking, knitted, F. Wilcomb 344,466
Stone crushers, pitman for, T. A. Blake 344,619
Stool and seat, A. H. Ordway 344,675
Stopper. See Bottle stopper.
Stove covers, pattern for moulding, Heckel, Jr., & Shade 344,377
Stove, oil, Q. S. Backus 344,513
Stove, oil, W. Mauerman 344,587
Stove or furnace, C. Garlick 344,647
Stove or furnace, heating, J. Adams 344,558
Stretching and smoothing embroidered and other fabrics, machine for, H. H. Hoge 344,577
Stuffing box, A. H. Clark 344,349
Submarine boat or vessel, Campbell & Ash 344,718
Surgical chair, W. B. Sanders 344,546
Swinging gate, S. Mutti 344,787
Switch. See Railway switch.
Table leg and hanger, combined, W. A. Otto 344,709
Table leg, detachable, J. W. McLain 344,392
Tags, making and stringing merchandise, etc., E. P. Kelsey 344,484
Tally, grain, J. Miller 344,395
Target trap, F. C. Damm 344,353
Target trap, A. E. Spangler 344,504
Tedders, coupling iron for, Thomas & Offutt 344,604
Telegraph and other circuits, signal box for fire, J. C. Wilson 344,430
Telegraph key and register, L. S. Crandall 344,351
Telegraphic instrument, G. W. Stewart 344,505
Telephone transmitter, E. Berliner 344,514
Tether stake, S. B. Sherer 344,683
Thill coupling, Slack & Crawford 344,549
Thill couplings, anti-rattler for, W. E. Murbarger 344,786
Thread cabinet, W. F. Streich 344,792
Timepieces, dial for, R. Tragardh 344,423
Tin from scrap or pieces of tin plate or tinned iron by means of hydrochloric acid, separating the, W. Hasenbach 344,575
Tool handle, L. Steinberger 344,552
Toy balloon, L. Biehl 344,515
Toy breech-loading gun, R. W. & A. G. Walker 344,698
Traction wheel, Lavering & Anspaugh 344,386
Trap. See Target trap.
Traveling bag or satchel, G. Wahler 344,696
Tread, step, mat, matting, etc., J. Whiteley 344,703
Tread, step, or mat, J. Whiteley 344,704
Tricycle brake, E. P. Howe 344,530
Tricycles, steering device for, E. P. Howe 344,531
Track, warehouse, Kistler & Buck 344,661
Truck wheel, G. F. Armstrong 344,471
Truss, T. M. Wilson 344,468
Tub or box cover fastener, A. B. Thomas 344,691
Tubes, machine for making, E. K. Coas 344,350
Tug, shaft, Adams & Lewis 344,431
Twist drills, machine for rolling, G. R. Stetson 344,754
Type writing machine, F. N. Cookson 344,627
Valve, J. H. Crosby 344,724
Valve, automatic stop, L. Schutte 344,501
Valve, check, J. G. Blount 344,620
Valve for steam engines, T. Brantley 344,742
Vehicle gear, C. M. Blydenburgh 344,712
Vehicle spring, Ludlum & Stevenson 344,785
Velocipede, S. W. Jones 344,449
Velocipede wheel, G. H. Day 344,442
Velocipedes, treadle motion for, E. P. Howe 344,529
Vessels, construction of, C. M. Catlin 344,622
Violin case, H. B. Tuttle 344,508
Wagon, dump, A. Helfrich 344,578
Wagons, combination rack for, M. Rice 344,751
Wall, roof, partition, etc., W. H. Johnson 344,581
Warping, beaming, and other machines, drop wire box for, T. C. Entwistle 344,365
Wash boiler, steam, G. S. Hurd *et al* 344,782
Washing machine, E. C. Weber 344,700
Watch case hinge, O. A. Drinkwater 344,727
Water, apparatus for separating solid impurities from, A. Howatson 344,740
Water motor, F. A. Hinds 344,737
Waterproof garment, F. G. Town 344,606
Weather strip, J. S. Duffee 344,773
Weather strip, W. D. Wright 344,798
Weigher, automatic grain, M. K. & F. S. Lewis 344,663
Well boring machine, Lewis & Starky 344,389
Well casings, reaming tool for use in sinking bored, W. A. Lloyd 344,744
Wheel. See Car wheel. Fifth wheel. Measuring wheel. Traction wheel. Truck wheel. Velocipede wheel.
Wheel and axle, G. W. Pittman 344,543
Whiffletree, J. E. Blackburn 344,560
Whiffletree, Gerber & Nicholas 344,574
Whistle, match safe, and cigar cutter, combined, A. Greth 344,570
Windmill, M. B. Williams 344,761
Window frame, plate glass, W. D. Smith 344,418
Windows and doors, trimming for, F. Koskul 344,742
Windows, blind way for, W. A. Holbrook 344,527
Wire gate, A. B. Hackman 344,372
Wire stretcher, Menefee & Mullinax 344,668
Wool conveyer, G. F. Hall 344,525
Wrench. See Pipe wrench.
Wrench and lock, combined, C. G. Wanemacher 344,427
Wringer. See Clothes wringer.

DESIGNS.

Bridle bit, W. Davis 16,758
Glass vessel, A. Lang 16,760
Ingot, metal, F. B. Morrow 16,762
Railway rail, Wharton, Jr., & Samuel 16,764
Rubber sole, R. Cowen 16,757
Rug, R. P. Hemming 16,759
Tubing, metal, A. F. Pfeifer 16,763
Woven fabric, J. R. MacColl 16,761

TRADE MARKS.

Abdominal supporter, W. Teufel 13,456
Bitters, Brown Chemical Company of Baltimore City 13,459
Canned corn, H. Zoller 13,458
Canned tomatoes, H. Zoller 13,457
Hats for men and boys, Austin, Drew & Co 13,450
Lockets, brooches, badges, and similar articles, E. R. Shipton 13,455
Paper, abrasive, H. Behr & Co 13,451
Papers, printing, writing, and book, Winona Paper Company 13,463
Pork, Kingan & Company 13,454
Sardines, dried prunes, and preserved peas, E. M. Dadelszen 13,452
Starch for laundry purposes, G. Fox Starch Company 13,453
Tobacco, extract of, J. Dunn 13,461
Undergarments for men, women, and children, W. Benger Soehne 13,464
Whisky, J. Clark 13,460
Whisky known as Kentucky sour mash, J. Eppstein & Co 13,462

A Printed copy of the specifications and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

GET THE BEST AND CHEAPEST

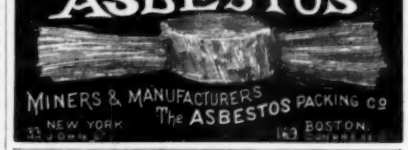
J. A. FAY & CO.,
(Cincinnati, Ohio, U. S. A.)
Exclusive Agents and Importers for the United States of the
CELEBRATED
PERIN BAND SAW BLADES,
Warranted superior to all others in quality, finish, uniformity of temper, and general durability. One Perin Saw outwears three ordinary saws.
Manufacturers of Planing Machines and other Patent Wood Working Machinery.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
LATHES Foot & Power

Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application
165 W. 3d St., Cincinnati, O.

MINERAL WOOL.
A fire-proof insulator of heat and sound. Samples and price list free. U. S. MINERAL WOOL CO.,
22 CORTLANDT STREET, N. Y.

ASBESTOS



2d HAND MACHINERY Lists sent. N.Y. Machinery Depot, Bridge Store No. 16, Frankfort Street, N. Y.

CONSTRUCTION OF STABLES. — A paper by A. W. Wright, describing a model stable just finished for the North Chicago City Railway. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 463. Price 10 cents. To be had at this office and from all newsdealers.

STAMPED METAL GOODS,
and other Articles in Brass and other Metals (the Dies and Tools for making same). Patent Novelties, Electrical Inventions, Special Machinery, Castings, &c. Manufactured to order by M. MARTIN, Manufacturer,
P. O. Box 285, New Brunswick, N. J.

ROCK DRILLS
AIR COMPRESSORS,
BOILERS, HOISTS,
AND
GENERAL MINING MACHINERY.
Send for Illustrated Catalogue.
Ingersoll Rock Drill Co.,
10 PARK PLACE, N. Y.

Card Press, $3. Circular Size, $6. Newspaper Size, $44.
Type setting, etc., easy by printed directions. For business or home use or money making. For old or young. Send 2 stamps for catalogue of presses, type, cards paper etc. to factory.
KELSEY & CO., Meriden Conn.

MICRO-ORGANISMS OF POTABLE Waters.—A paper by Dr. T. Leone, showing that atmospheric oxygen is not an element necessary for the increase of microbia in potable waters, and that the carbonic acid is the sole agent that interferes with the life of these organisms in carbonic acid waters. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 524. Price 10 cents. To be had at this office and from all newsdealers.

Syracuse Malleable Iron Works

DRAINAGE.—A SERIES OF VERY excellent directions for draining railways, roads, etc., by Mr. Charles Paine. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 468. Price 10 cents. To be had at this office and from all newsdealers.

PERFECT
NEWSPAPER FILE

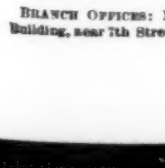
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

AMERICAN STEAM BOILER INSURANCE CO.,
45 William Street, New York.
Write for Special Blanket Form No. 99 gives complete protection to property, and pays $5,000 for a life and $50 weekly for six months for injury.

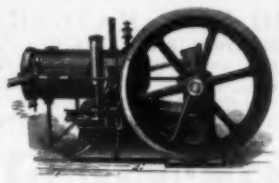
Edco System
Of Arc and Incandescent Lighting.
Electric Light and Power.
Motors, Dynamos, Lamps, and Batteries in all varieties.
Electro-Dynamic Co., 124 Carter St., Philadelphia.
W. W. Griscom, Consulting Electrical Engineer.

THE IMPROVED
Rider Hot Air Pumping Engine
For City or Country Residences,
Burns Coal, Wood, or Gas. Safe, Simple Durable. 3,000 in use. Send for Illustrated Catalogue "A."
SAYER & CO., 37 Dey St., New York.

THE FACT IS
NEWSPAPER ADVERTISING Pays Best WHEN PROPERLY DONE.
WE AIM TO AND DO GIVE TO ALL CUSTOMERS, LOWEST PRICES---PROMPT TRANSACTIONS---JUDICIOUS SELECTIONS---CONSPICUOUS POSITIONS---EXPERIENCED ASSISTANCE---UNBIASED OPINIONS AND CONFIDENTIAL SERVICE.
ADVERTISEMENTS DESIGNED, PROOFS SHOWN AND ESTIMATES OF COST IN ANY NEWSPAPERS, FURNISHED TO RESPONSIBLE PARTIES FREE OF CHARGE.
The H. P. Hubbard Co.,
Successors to H. P. HUBBARD,
Judicious Advertising Agents and Experts,
Established 1871. Incorporated 1885.
New Haven, Conn.
☞ OUR 200 PAGE CATALOGUE OF "LEADING NEWSPAPERS," SENT FREE ON APPLICATION.

2 to 25 H. P.

CHARTER'S GAS ENGINE.
Warranted equal to any in Power and Economy, and Superior to all in Simplicity and Compactness. Gives an Impulse at every Revolution.
Engines and Pumps Combined.
Williams & Orton Mfg. Co.,
P. O. Box 148. STERLING, ILLS.

PULLEYS.
Order from our "Special List."
THE JOHN T. NOYE MFG CO.,
BUFFALO, N. Y.


GAS ENGINES.
Best in principle, workmanship, and materials.
An unequaled small Motor adapted to all uses.
When the motor is not at work, the expense of running it ceases.
Simple, Safe, Economical, Durable. No extra insurance.
Four sizes: 1 H. P., ½ H. P., 1 man power, and Dental Engine.
These Engines are especially suited for Gasoline Gas for country use.
☞ *Send for Illustrated Catalogue.*
ECONOMIC MOTOR CO.,
Office and Salesrooms, 9 CORTLANDT ST., NEW YORK.

THE CHEAPEST AND BEST
PHOTO ENGRAVING CO.
67 PARK PLACE, NEW YORK
ENGRAVING FOR ALL ILLUSTRATIVE AND ADVERTISING PURPOSES

SHIELDS & BROWN
Manufacturers and Sole Proprietors of

For BOILERS and STEAM PIPES
Reduces Condensation of Steam.
FOR GAS AND WATER PIPES.
Prevents Sweating and Freezing.
The Best Non-Conductor of Heat and Cold in the World
Send for illustrated descriptive Circular, and name this paper.
143 Worth Street, New York.
78 and 80 Lake Street, Chicago.

FREE TO F. A. M. Fine Colored Engraving of the Old Sun Tavern in Philadelphia, where the first lodge in N. America was organized. Also large illustrated Catalogue of Masonic books and goods with bottom prices. Also offer of first-class business to F. A. M. Beware of spurious work. REDDING & CO., Masonic Publishers and Manufacturers, 731 Broadway, New York.

HOISTING ENGINES and Boilers for every possible duty.
New catalogue ready.
LIDGERWOOD MANUFACTURING CO., 96 LIBERTY STREET, NEW YORK.

PIPE COVERINGS
Made entirely of ASBESTOS.
Absolutely Fire Proof.
BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y.

ICE & REFRIGERATING Machines. Jarmans Patent. YORK MFG. CO., York, Pa.

NOVELTY ELECTRIC CO.
Learner's Novelty Diamond Telegraph Instrument is the latest and best.
Factory and Store, 5th and Locust Sts., Philadelphia.

O. JUDD CO.'S Newest Publications.

Through the Yellowstone Park on Horseback.....$1.50
By GEN. GEO. W. WINGATE, the noted rifleman and one of the founders of Creedmoor. Most profusely illustrated by FORBES, CARY, and BENNETT. This volume is one of surpassing interest, describing last Summer spent by General Wingate and his family in the Yellowstone, and affords a vast amount of information regarding a most delightful Summer trip. After reading this volume, Summer tourists will go to Yellowstone instead of going to Europe.

Profits in Poultry. Useful and Ornamental Breeds.....$1.00
The cheapest and most valuable publication ever issued on this industry. Contains the combined experience of practical men in all the Departments of Poultry raising. Edited by WELD, JACOBS, and FERRIS. Over 100 illustrations. Bound in Cloth.

How to Handle and Educate Vicious Horses.....$1.00
By OSCAR R. GLEASON. In addition to full directions for Handling Vicious Horses, Breaking Colts, etc., the volume comprises very instructive chapters on Teaching Horses Tricks, How to Tell the Age of Horses, Shoeing, Diseases, Ladies' Equestrianism; also a dissertation on Dogs, How to Teach them, and How to Treat their Diseases.

The Law of Field Sports.....$1.00
A Summary of the Rules of Law Affecting American Sportsmen. By GEORGE PUTNAM SMITH. A most useful and valuable work. Full of information which all Sportsmen will be glad always to have at hand.

The Bridle Bits.....$1.00
A Treatise on Practical Horsemanship. By COL. J. C. BATTERSBY. A valuable little work on horsemanship and the horse's mouth, by an accomplished horseman and experienced cavalry officer.

The Percheron Horse.....$1.00
In America, by COL. M. C. WELD. In France, by CHARLES DU HAYS. The history of the Percheron in America, their increasing popularity, and influence on the horse stock of the country, are concisely treated by Col. Weld; while the history of the breed, its origin, systematic improvement, etc., are treated by Mons. Chas. Du Hays, the most distinguished of French authors writing upon the horse. Cloth, 12mo.

For sale by all dealers or sent post-paid by the publishers on receipt of price. Our full descriptive catalogue on application.
O. JUDD CO., 751 Broadway, New York.

WORKSHOP RECEIPTS.
For the use of Manufacturers, Mechanics, and Scientific Amateurs. The best late collection published of such a wide variety of information.

FIRST SERIES.—Bookbinding; Candles; Drawing; Electro-Metallurgy; Engraving; Gilding; Japans; Photography; Pottery; Varnishing, etc. 450 pages, with illustrations. $2.00

SECOND SERIES.—Industrial Chemistry; Cements and Lutes; Confectionery, Essences, and Extracts; Dyeing, Staining, and Coloring; Gelatine, Glue, and Size; Inks; Paper and Paper Making; Pigments, Paint, and Painting, etc., ... $2.00

THIRD SERIES.—Alloys, Electrics, Enamels and Glazes, Glass, Gold, Iron, and Steel, Lacquers and Lacquering, Lead, Lubricants, Mercury, Nickel, Silver, Tin, Vanadium, Zinc, etc. 480 pages, 185 illustrations, . $2.00

FOURTH SERIES.—Waterproofing; Packing and Storing; Embalming and Preserving; Leather Polishes; Cooling Air and Water; Pumps and Siphons; Desiccating; Distilling; Emulsifying; Evaporating; Filtering; Percolating and Macerating; Electrotyping; Stereotyping; Bookbinding; Straw-plaiting; Musical Instruments; Clock and Watch Mending; Photography, etc. $2.00

☞ Send for our complete Catalogue of books, free to any address.

☞ In ordering single volumes, be particular to mention the "series" wanted.

Sent postpaid by MUNN & CO., 361 Broadway, New York, on receipt of price.

SHEPARD'S NEW $60
Screw-Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.
Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address H. L. Shepard, Agent, 134 E. 2d St., Cincinnati, O.

Mention this paper.

THE MANUFACTURE OF CRUCIBLE Cast Steel.—A paper read before the Steel and Iron Institute by Henry Seebohm. A presentation of the facts connected with the old-fashioned method of converting bar iron into steel and then melting it in clay pots to form ingots of cast steel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **464.** Price 10 cents. To be had at this office and from all newsdealers.

FREE TRIAL.—NERVITA speedily cures all effects of youthful errors. Nervous Debility, Involuntary Losses, Lost Manhood, and kindred affections. **TRIAL** package 12 cents postage. Free at office. DR. A. G. OLIN CO., 150 E. Washington St., Chicago.

CURE FOR THE DEAF
PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS Perfectly Restore the Hearing, and perform the work of the natural drum. Invisible, comfortable and always in position. All conversation and even whispers heard distinctly. Send for illustrated book with testimonials, FREE. Address or call on F. HISCOX, 853 Broadway, New York. Mention this paper.

TO WEAK MEN suffering from the effects of youthful error, early decay, lost manhood, etc. I will send a valuable treatise (sealed) containing full particulars for home cure, free of charge. Address Prof. F. C. FOWLER, Moodus, Conn.

WEAK, UNDEVELOPED PARTS
Of the body enlarged and strengthened. Simple, unfailing self-treatment. Full explanation, references, &c., sent sealed free. ERIE MEDICAL CO., BUFFALO, N. Y.

FIRE DAMP IN COAL MINES.—DEscription of apparatus invented by H. G. Carleton for indicating the presence of fire damp, with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **528.** Price 10 cents. To be had at this office and from all newsdealers.

SLATE ROOF COVERINGS.—BY JOHN Slater. Characteristics of good slate, sizes of slate, laying slate. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **498.** Price 10 cents. To be had at this office and from all newsdealers.

FOREIGN PATENTS.

Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law which went into force on Jan. 1st, 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India, Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and other information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, MUNN & CO.,
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

EDUCATION OF THE AMERICAN Citizen.—A lecture by Prof. R. H. Thurston on the theme: "How may we best aid in those mighty social movements and those tremendous political changes which mark the mighty progress of the race toward a better and a more prosperous future?" Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **524.** Price 10 cents. To be had at this office and from all newsdealers.

SCHOOL OF ENGINEERING.
Rose Polytechnic Institute, Terre Haute, Indiana.
$26,000 income from endowment. Mechanical, Civil and Electrical Engineering. Drawing and Chemistry. Manufacturing Shops. Send for Catalogue
Address C. A. WALDO, Vice President.

SWIMMING.—DESCRIPTION OF THE method of teaching swimming employed in France; with 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **462.** Price 10 cents. To be had at this office and from all newsdealers.

ADDRESS OF PROF. T. H. HUXLEY on resigning the Presidency of the Royal Society, Nov. 30, 1885. Results of the rapid progress of science. Influence on the moral, social and political relations of man. What should be done for the advancement of science. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **527.** Price 10 cents. To be had at this office and from all newsdealers.

TRANSMISSION OF POWER TO A DIstance.—By Arthur Achard. A paper read before the Institution of Mechanical Engineers. Being a summary of the practical results obtained in the transmission of power to a distance by different modes. I. Transmission of Power by Wire Ropes, and the formulæ for calculation. II. Transmission by Compressed Air, with formulæ. III. Transmission by Pressure Water, with formulæ. IV. Transmission by Electricity. General results obtained by the several methods. This is one of the most valuable, practical, and comprehensive papers on the subject recently published. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **274** and **275.** Price 10 cents each. To be had at this office and from all newsdealers.

APPLICATIONS, with Testimonials, to fill the Chair of Mechanics; Natural Philosophy; Drawing (Free Hand and Mechanical), and Mining Engineering; will be received by the Secretary of the Board of Trustees of the Virginia Agricultural and Mechanical College until July 27, 1886. Salary $1,500.
Address PROF. W. H. GRAHAM,
Secretary of Board Va. A. & M. College, Blacksburg, Montgomery Co., Virginia.

ON SEWAGE DISPOSAL—BY PROF. H. Robinson. Sewage disposal on land. Sewage disposal by chemical treatment. Sewage disposal by discharge into river or sea. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **467.** Price 10 cents. To be had at this office and from all newsdealers.

POLISHING FELTS.
ALFRED DOLGE,
MANUFACTURER,
122 East 13th Street, NEW YORK.

TESTS OF CEMENT.—REPORT OF the committee on a uniform test for cement. Cement tests. Fineness, checking or cracking. Tests recommended, mixing, etc., setting, sampling, sieves, moulds, machines, with 3 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **526.** Price 10 cents. To be had at this office and from all newsdealers.

THE CONVERSION OF HEAT INTO useful work.—A series of interesting lectures by Wm. Anderson, M. Inst. C.E., presenting the modern views connected with the conversion of heat into useful worke I. Laws of motion, the principles of work and energy, and the laws of impact. II. Theories of oscillation and vibration. III. Properties of gases and vapors. IV. Transfer of the invisible molecular motion of heat, and its change into the coarser and apparent motion of mechanical work. V. How the waste of heat in furnaces is prevented by the Siemens regenerator. The principle further illustrated. Cowper stoves. The gun as a converter of heat. VI. Heat engines proper. Illustrated, with 52 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. **498, 499, 500, 501, 502, 503.** Price 10 cents each, or 60 cents for the series. To be had at this office and from all newsdealers.

The AMERICAN INSTITUTE
of Phrenology and Physiognomy opens its twenty-first annual session Tuesday, Sept. 7. All who would learn to read character and to manage people, may send for "Institute Circular."
Fowler & Wells Co., 753 Broadway, New York.

MACHINERY AND EDUCATION.—A lecture by Dr. R. W. Raymond, pointing out some interesting analogies between the evolution illustrated in the growth of natural forms in the visible world and the development and adaptation of the human mind and thought, as modified by environment and education. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **525.** Price 10 cents. To be had at this office and from all newsdealers.

The Standard Typewriter
The Caligraph.
LIFE IS SHORT—WRITE QUICK—THE OLD WAY
Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway.

DRY AIR REFRIGERATING MACHINE. Description of Hall's improved horizontal dry air refrigerator, designed to deliver about 10,000 cubic feet of cold air per hour, when running at a speed of 100 revolutions per minute, and capable of reducing the temperature of 90° above to 50° below zero. With five figures, showing plan and side elevation of the apparatus, and diagrams illustrative of its performance. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **488.** Price 10 cents. To be had at this office and from all newsdealers.

THE REASONING FACULTY OF ANImals.—By Joseph F. James. An interesting paper, in which the author contends that instincts in animals are not of divine origin, but come into existence in obedience to natural laws, and in many cases ought to rank with the reason of man. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **298.** Price 10 cents. To be had at this office and from all newsdealers.

CIVIL, MECHANICAL AND MINING ENGINEERING at the Rensselaer Polytechnic Institute, Troy, N. Y. The oldest engineering school in America. Next term begins September 15th. The Register for 1886 contains a list of the graduates for the past 61 years, with their positions; also course of study, requirements, expenses, etc. Address
DAVID M. GREENE, Director.

The only Real Treatise on the Subject.
The Windmill as a Prime Mover.
Comprehending everything of value relating to Windmills, their Use, Design, Construction, etc. With many fine illustrations. By A. R. WOLFF, M.E., Consulting Engineer. 8vo, cloth, $3.00
Mailed prepaid on the receipt of the price. Address
MUNN & CO., 361 Broadway, New York.

MODERN BRONZE ALLOYS.—A PAper by P. F. Nursey, C.E., presenting some valuable data concerning such bronzes as are being usefully employed for engineering purposes. The bronze of the ancients. Composition of bronzes. Phosphor bronze and its applications. Silicium bronze. Manganese bronze. Delta metal. Phosphor-copper. Phosphor-manganese bronze. Phosphor-lead bronze. Phosphor-tin. Aluminum bronze. Silveroid. Cobalt bronze. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **465.** Price 10 cents. To be had at this office and from all newsdealers.

MALLEABLE AND FINE GRAY IRON ALSO STEEL
CASTINGS FROM SPECIAL PATTERN
FINE TINNING JAPANNING AND FINISHING
THOMAS DEVLIN & CO.
LEHIGH AVE. & AMERICAN ST. PHILA.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

The New Catalogue of Valuable Papers
contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, N. Y.

HYDRAULIC FLANGED HEADS,
OF IRON OR STEEL, FOR BOILER AND TANK MAKERS.
Unequaled for Strength and Uniformity.
THE DICKSON MANUFACTURING CO.
SCRANTON, PA.
96 Lake Street, Chicago. 57 Oliver Street, Boston. 112 Liberty Street, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

To Business Men.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page, or address

MUNN & CO., Publishers,
361 Broadway, New York.

BOSTON SEWAGE WORKS.—A FULL description of the system, accompanied with a map showing the general arrangement, and discharge into the harbor, and with 26 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 524. Price 10 cents. To be had at this office and from all newsdealers.

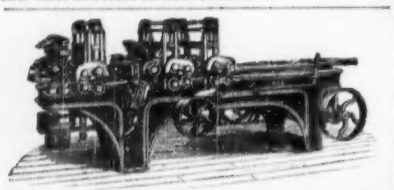
H. W. JOHNS'
ASBESTOS
ROOFING

FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail,

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.:
CHICAGO. PHILADELPHIA. LONDON.

LIGHTNING RODS.—DESCRIPTION OF of the arrangement adopted by Mr. Meisens for protecting the Brussels Hotel de Ville against lightning. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 525. Price 10 cents. To be had at this office and from all newsdealers.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

REMOVAL OF SEWAGE.—BY W. H. White, C.E.—The five methods in use in Europe, and their relative values. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 527. Price 10 cent. To be had at this office and from all newsdealers.

A PRACTICAL SUCCESS.
VAN DUZEN'S PAT. LOOSE PULLEY OILER.

Thousands in satisfactory everyday use. Entire reliability and constancy demonstrated in a two years' test by (would 'no) Eastern skeptics. Economy shown by reasonable prices and perfect performance. Send for our "Catalogue No. 55."
VAN DUZEN & TIFT, Cincinnati, O

MODEL and EXPERIMENTAL WORK — A SPECIALTY.
Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

VASELINE, PETREOLINE, NEUtraline.—Their method of manufacture, characteristics, and various uses. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 485. Price 10 cents. To be had at this office and from all newsdealers.

WM. A. HARRIS,
Providence, R. I. (Park St.) 8 minutes' walk West from station.
Original and Only Builder of the
HARRIS-CORLISS ENGINE,
With Harris' Pat. Improvements, from 10 to 1,000 H. P.
Send for copy Engineer's and Steam User's Manual. By J. W. Hill, M.E. Price $1.25.
MENTION THIS PAPER.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.!

BLAKE'S IMPROVED PIPE HANGER.
IT IS THE CHEAPEST AND BEST HANGER IN THE MARKET.

It saves many expensive Blacksmiths' Jobs. Can be attached to pipe when in position. Expansion always provided for. Cheap because it is simple. Pitch lines of mains easily obtained. No troublesome screws to adjust.

JENKINS BROS., SOLE AGENTS,
71 JOHN ST., NEW YORK. 13 SO. FOURTH ST., PHILA. 79 KILBY ST., BOSTON.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's Book of SAWS. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address SAW
EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.

WANTED price lists and particulars of American Engines, Tools and Novelties. Send postpaid to T. Van Zwieten & Co., Importers, Sole Agents, Rotterdam, Netherlands.

QUARTZ AND ITS VARIETIES.—BY W. S. Beekman.—With distribution of quarts, chemical composition, varieties, characteristics. Commercial uses and value. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

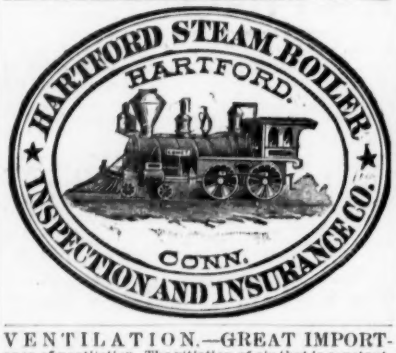
THE TEMPLE OF SOLOMON.—A REview, by E. C. Robins, F.S.A., of the various theories that have been held respecting the form and the style of architecture of Solomon's Temple, with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 529. Price 10 cents. To be had at this office and from all newsdealers.

LUBRICATING OILS.—A PAPER BY C. J. H. Woodbury, giving the results of the examination of a single lubricant under a wide range of investigation concerning its friction. Illustrated with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 473. Price 10 cents. To be had at this office and from all newsdealers.

Mineral Lands Prospected

Artesian Wells Bored. Superior Stationary Engines, specially adapted to Electric Light purposes. Built by PA. DIAMOND DRILL CO., Birdsboro, Pa.

PUNCHING HOLES IN SOFT STEEL.—A paper by V. N. B. Guerhard, giving the results of experiments undertaken to ascertain the influence of punching holes in soft steel. With 12 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 472. Price 10 cents. To be had at this office and from all newsdealers.



VENTILATION.—GREAT IMPORTance of ventilation. The vitiation of air that is constantly going on in inhabited places, exhaustion of oxygen by gas, candles and lamps. Ventilation by natural and artificial means. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 525. Price 10 cents. To be had at this office and from all newsdealers.

INTERNATIONAL INSTITUTE FOR
Liquefied Carbonic Gas.
O. BRUNLER, 857 Broadway, New York.

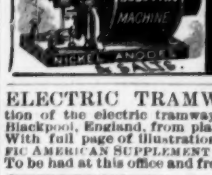
PROGRESS IN ASTRONOMICAL Telescopes.—By W. R. Warner. How the first telescopes were constructed. Galilio's telescope. Herschel's modifications. The Cassegranian system. Methods of overcoming chromatic aberration. Improvements in telescopes and accessories during the last fifty years. Some of the more celebrated telescopes of recent times. Illustrated with 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 485. Price 10 cents. To be had at this office and from all newsdealers.

EPPS'S
GRATEFUL—COMFORTING.
COCOA

ASBESTOS.—NATURE OF THE MINeral, where found. The best kinds. How manufactured. Illustrated with 2 figures of machinery, and a plan of the Harefield Asbestos Works. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 485. Price 10 cents. To be had at this office and from all newsdealers.

STEAM ENGINES.
Horizontal and Vertical.
Dredging Machinery. Flour, Powder, Slate and Flint Mill Machinery, Turbine Water Wheels.
York Mfg Co., York, Pa. U. S. A.

NICKEL PLATING
& POLISHING MATERIALS.
ZUCKER & LEVETT
CHEMICAL Co NEW YORK U.S.A.



NICKEL & ELECTRO PLATING OUTFITS.

ELECTRIC TRAMWAYS.—DESCRIPtion of the electric tramway recently constructed at Blackpool, England, from plans by Mr. Holroyd Smith. With full page of illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

Write for Circular and tell us what you want.
B. W. PAYNE & SON, Drawer 1001, Elmira, N. Y.
New York Office: 107 Liberty Street.
Eastern Agents, HILL, CLARKE & CO., Boston, Mass.
Our patented Vertical Boiler will not prime. No danger of burning flues.

ROTARY ENGINES.—DESCRIPTION of several types of effective rotary engines with inclined shafts. With 6 figures explanatory of the method of coupling the shafts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

Barnes' Pat. Foot and Hand Power
MACHINERY, $15.

Contractors and Builders, Cabinet Makers and Jobbers in Wood or Metal, who have no steam power, can, by using outfits of these machines, bid lower and save more money than by any other means for doing their work. Sold on trial. Illustrated Catalogue FREE.
W. F. & JOHN BARNES CO.,
Address 1999 Ruby St., Rockford, Ill.

SOURCES OF SALTPETER.—A PAper by C. G. W. Lock, indicating the chief localities of production, and describing processes of extraction. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

OPERA GLASSES Microscopes, Telescopes, Spectacles, Barometers, Thermometers, Photographic Outfits for Amateurs.
W. H. WALMSLEY & CO. successors to R. & J. Beck, Philadelphia. Illus. Price List free to any address.

REGENERATIVE GAS FURNACES.—A new method of heating, by Frederick Siemens. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 472. Price 10 cents. To be had at this office and from all newsdealers.

DROP FORGINGS
FINISHED TOOLS
BILLINGS & SPENCER Co.
HARTFORD, CONN.

CONCRETE AS A BUILDING MAterial.—A paper by Thomas Potter, calling attention to some of the less generally known, but most vital, points in connection with the production of good concrete for building purposes. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 487. Price 10 cents. To be had at this office and from all newsdealers.

Bibb's Celebrated Original
BALTIMORE
FIRE-PLACE HEATERS,
To warm upper and lower rooms. The handsomest, most economical Coal Stoves in the world.
B. C. BIBB & SON
Foundry Office and Salesrooms, 39 and 41 Light Street, Baltimore, Md.
MARBLEIZED SLATE MANTELS.
Send for Circulars.

HEATING BUILDINGS BY STEAM.—By J. H. Bartlett, M. Inst., M.E. A description of the Holly system of generating steam at a central point, transmitting it by mains to suitable distances, and utilizing it for heat or power by means of mechanical devices. With 3 engravings. Continued in SCIENTIFIC AMERICAN SUPPLEMENT No. 487. Price 10 cents. To be had at this office and from all newsdealers.

BARREL, KEG,
Hogshead,
AND
Stave Machinery.
Over 50 varieties manufactured by
E. & B. HOLMES,
Fan and Stave Jointer. BUFFALO, N. Y.

NOTICE to Users of Steam Pumps.
We have received following letter in regard to one of our No. 5 "L" ($16) Steam Jet Pumps elevating 1½ inch pipe of water more than 50 feet high:
"L'ANSE, MICH., Feb. 24, 1883.
"VAN DUZEN & TIFT, Cincinnati, O.:
"Money could not buy the Jet of us unless another could be had. I would not give your No. 5 "L" for a $700 pump, equal distance to raise.
"N. A. Litchfield, Supt. Mich. Slate Co."
We make Ten Sizes of these Pumps. Prices $7 to $75. Capacities 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps."
VAN DUZEN & TIFT, Cincinnati, O.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

HEAT IN RELATION TO CHEMICAL Action. By Henry Allen. A review of some of the results that have recently been obtained by experimenters in the branch of physics known as thermo-chemistry. Description of apparatus used by M. Berthelot in his calorimetric determinations. The fundamental principles of thermo-chemistry explained. Decomposition of water by metals. Action of hydrochloric acid. Sulphides. Nitric acid. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 291. Price 10 cents. To be had at this office and from all newsdealers.

DRAWING INSTRUMENTS. Illustrated catalogue sent on application to WM. T. COMSTOCK, 6 Astor Place, New York.

PROSPECTUS
OF THE
Scientific American
FOR 1886.
The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—**One extra copy** of the SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.00 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway New York.

THE
Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of

MUNN & CO., 361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.